FEBRUARY, 1949 Vol. 38, No. 2

Industrial Arts and Vocational Education

The Shop Teachers' Professional Magazine

TESTING NUMBER

How Pittsburgh Color Dynamics Contributes to Protection of Your Food and Beverages

Teach your students how scientific use of the energy in color reduces eye fatigue, accidents and absenteeism—improves quality and quantity of production.

TRAINING of skilled shopmen is no longer limited to teaching them about metals, machinery and methods. More and more industry is recognizing the influence of physical and psychological factors upon workmen.

That is why so many educators in our industrial and vocational schools now include Pittsburgh's COLOR DYNAMICS in their courses.

This painting system is based upon the reactions of human beings to the *energy in color*. Tests have proved that some colors stimulate, others are restful, still others depress—even cause irritation and discomfort.

In COLOR DYNAMICS, colors are classified according to their energy. *Focal* colors on machinery assist concentration. *Eye-rest* colors relax the eyes and ease nervous tension. *Morale-building* colors promote cheerfulness and restrain mental depression. *Safety* colors warn workers of impending dangers.

Shop executives are learning that by proper use of these colors on machines, walls, floors and ceilings *more work per man-hour and more man-hours per man* result! No better proof of this fact can be offered than the improvement in production and morale wherever COLOR DYNAMICS has been applied.

Begin now to teach COLOR DYNAMICS in your school. Write today for a free copy of our book which explains this new painting method. Packed with interesting data and practical suggestions, it is an excellent textbook. Pittsburgh Plate Glass Company, Pittsburgh 22, Pa.

Paint RIGHT with Color Dynamics Paint BEST with Pittsburgh Paint!

The benefits of COLOR DYNAMICS are made more enduring when you use Pittsburgh's high-quality paints.

WALLHIDE—available in four types: **FLAT**—a velvet-like finish; **SEMI-GLOSS**—with higher sheen; **GLOSS**—with enamel-like sheen; **PBX**—extra-durable finish can be washed frequently.

LAVAX PBX ENAMEL—for woodwork, furniture or metal trim. Brushes out freely and easily to a smooth, satin finish.

FLORHIDE—for wood or metal floors and steps. Quick-drying, tough, can be scrubbed with soap solutions.

LAVAX MACHINERY ENAMEL—a durable finish impervious to grease, grime or dirt.

SEND FOR A COPY OF THIS BOOK!

● Our booklet—"COLOR DYNAMICS IN INDUSTRY"—explains this new painting system and how you can use it in your plant. Mail this coupon for your FREE copy.

Pittsburgh Plate Glass Co., Paint Div., Department IV-29, Pittsburgh 22, Pa.

Name_____

Street_____

City_____ State_____

PITTSBURGH PAINTS

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

South Bend 16" Lathes in The Technological Institute of Northwestern University

Their Future Is Yours

Tomorrow's top men of industry are in your classes today. The training they are receiving will gauge their future success. It is important that they acquire a thorough knowledge of basic industrial processes and methods. This is necessary in order to keep pace with the rapid progress of technological sciences. Consequently, practical shop courses command an important role in their education. Let their success reflect the thoroughness of your teaching.

TEACHING HELPS — CATALOGS

Write for Bulletin No. 21 which describes booklets, operator's manual, movie films, wall charts, etc., available for instructional purposes.

Ask for Catalog 100-G for Lathe information, Catalog No. 400 for information on Drill Presses.

SOUTH BEND LATHE WORKS

BUILDING BETTER TOOLS SINCE 1906 • 466 EAST MADISON STREET, SOUTH BEND 22, INDIANA

FINE TRAINING...

rates Snap-on Tools

Your students are the skilled mechanics of the future . . . the logical reason why you should acquaint them during their training period with fine Snap-on Tools — the choice of better mechanics everywhere. Using modern Snap-on Tools means early development of superior workmanship, speed, dexterity. These are attributes that reflect credit to you in growth of students to capable mechanics.

SNAP-ON TOOLS CORPORATION

8074-B 28TH AVENUE KENOSHA, WISCONSIN

Shop Benches BY SJÖSTRÖM

PROMPT DELIVERY

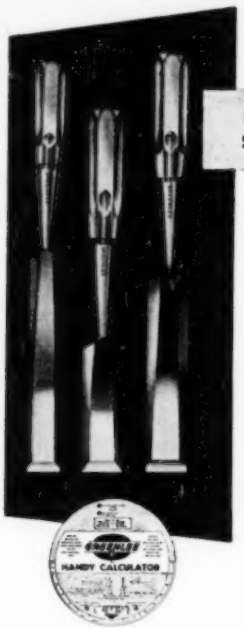
Sturdy Sjöström Work Benches—

- Ideal for school shops where long life and maximum utility are a "must".
- Attractive heavy duty construction—natural finish maple and birch, with stout 2¼" edge grain tops; tops and bases bolt reinforced.
- Four types—single (52" x 22" x 32") and two student (52" x 36" x 32") types; with or without tool drawers of durable dovetailed construction.
- Equipment for each student—continuous screw vise with ample 4" x 7" jaws, metal bench hook and dog.

Write Today for Prices and Specifications.

JOHN E. SJÖSTRÖM COMPANY

1715 N. Tenth Street, Philadelphia 22, Penna.



Announcing

NEW GREENLEE SOCKET CHISELS

WITH HARD-WEAR HANDLES OF TOUGH, TRANSPARENT GREEN TENITE

The latest thing in chisels, fitted with handsome new GREENLEE Hard-Wear Handles. Tough . . . hammer and pound them all you like. Weather-resistant . . . wet, dry, hot or cold, weather has no effect on these new handles. Long-lasting blades with fine-cutting edges. See your dealer.

GREENLEE

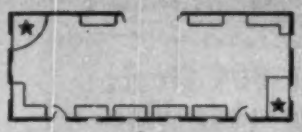
SPECIAL OFFER . . . ONLY 10¢ for HANDY GREENLEE WOOD-WORKING CALCULATOR quick solutions to countless wood working problems. Converts linear to board feet, gives slope per foot, nail and bit sizes, etc. 6" diameter. Send coin to Greenlee Tool Co., 2022 Twelfth Street, Rockford, Illinois.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, February, 1949, Volume 38, No. 2. Published monthly, except July and August, by The Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. Entered as Second-Class Matter January 2, 1914, at the Post Office at Milwaukee 1, Wis., under the act of March 3, 1879. Subscription price in the U. S., Canada, and countries of the Pan-American Union, $3.00 per year; Foreign, $3.50; Single copies, 35 cents.

SPOT these $38 BENCH GRINDERS Around Your School Shop for CORRECT SHOP PRACTICE!

AT THIS LOW PRICE
YOU CAN USE SEVERAL
BLACK & DECKER 6" STANDARD
BENCH GRINDERS

KEEP THEM HANDY



for Your Students!

MANY PRACTICAL FEATURES!

- Constant speed Black & Decker 1/4 H.P. motor gives ample power for "run-of-shop" jobs—yet is economical to run.
- Full-size bearings on rotor and wheel spindles, covered by protective sleeves.
- Tool rests locked in base grooves with winged nuts for easy adjustment.
- Base equipped with four rubber feet for benchwork use, or units may be quickly bolted to new streamlined pedestals for spotting anywhere in the shop.
- Wheel guards are cast integral with the motor housings. One medium 6" Grinding Wheel and one 6" Wire Wheel Brush are included as standard equipment.

HANDLE Grinding, Wire Brushing, Buffing!

Keeping tools sharp and clean is the mark of a good mechanic. And you'll find it's easier to train your students in these correct habits when you install several Black & Decker 6" Standard Bench Grinders within easy reach . . . at strategic points in your shop. These sturdy, well-balanced Bench Grinders are economical to buy—economical to operate—sure to increase the efficiency of your training. With grinding wheels, they clean and sharpen tools, do many types of grinding and metal removing. With B & D "Whirlwind" Wire Wheel Brushes, they remove rust; prepare surfaces for painting; clean valves, spark plugs and other gummy, dirty automotive parts. Ask your nearby Black & Decker Distributor for a demonstration.

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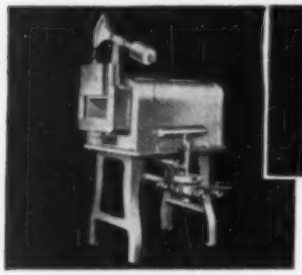
Black & Decker

PORTABLE ELECTRIC TOOLS

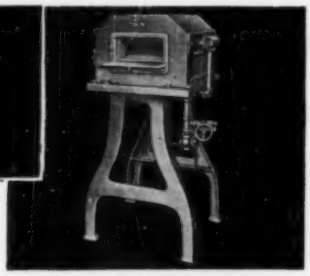
Write for free catalog to: The Black & Decker Mfg. Co., 680 Pennsylvania Ave., Towson 4, Maryland.



Small Semi-Muffle Oven

Sunbeam STEWART

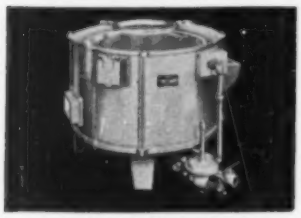
THE BEST INDUSTRIAL FURNACES MADE



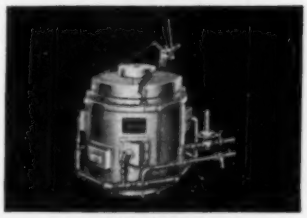
Small Forge

HUNDREDS OF THESE SUNBEAM STEWART FURNACES ARE IN THE VOCATIONAL DEPARTMENTS OF TECHNICAL SCHOOLS

Because Sunbeam Stewart units have been designed for efficient production heat treating in small shops and tool rooms, they are widely recognized as standard equipment for all types of industrial heat treating and vocational training work. For student instruction and reference write for our free "Guide to Furnace Selection." Aids in determining the type of furnace best suited for any work. Also ask for the new Data File on school units.



Round Pot Furnace



Melting Furnace

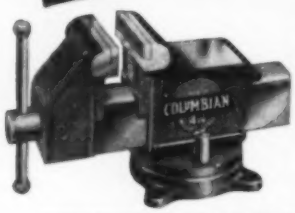
SUNBEAM STEWART INDUSTRIAL FURNACE DIVISION OF SUNBEAM CORPORATION (Formerly CHICAGO FLEXIBLE SHAFT CO.)

Main Office: 4433 Ogden Ave., Dept. 114, Chicago 23, Ill.
New York Office: 322 W. 48th St., New York 19, N. Y.

Bench Oven Furnace — Triple Purpose Combination "E" — Triple Purpose Combination "D" — Dual Combination

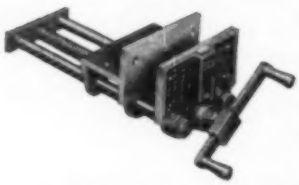
New Columbian 804 Steel Welded Workshop Vise

With Handy Removable Pipe Jaws



The Columbian 804 Work Shop Vise is a rugged all-purpose vise of steel construction — fabricated by arc welding. Front and back jaws are welded from heavy steel. Screw and handle are cold rolled steel. Each Columbian 804 is finished in red enamel and packed in individual cartons.

Columbian Workshop Vise



★ Columbian Continuous Screw Woodworker's Vises are furnished with hard wood handles — or may be equipped with ADJUSTABLE STEEL HANDLES as above, to eliminate handle breakage, speed operation and provide extra leverage.

THE COLUMBIAN VISE & MFG. CO.

9022 Bessemer Avenue • Cleveland 4, Ohio

THE WORLD'S LARGEST MAKERS OF VISES

ARMSTRONG

New TOOL HOLDERS MAKE MORE PROFIT ON EVERY OPERATION

With ARMSTRONG TOOL HOLDERS you can take advantage of the new high speeds and heavier feeds of the newer cutting materials, without revolutionary changes or costly experimentation. They are the most profitable tools obtainable; the lowest in initial cost, the longest in service and most economical in use, for all incorporate the basic ARMSTRONG Principle of small interchangeable cutter-bits in permanent drop forged shanks. They are the most readily obtainable tools, too, for they are stocked by all leading distributors.

WRITE FOR CIRCULARS DESCRIBING:

(1) ARMSTRONG Carbide TOOL HOLDERS and ARMIDE (Carbide Tipped) Cutters.

(2) ARMSTRONG C A TOOL HOLDERS and ARMALOY (Cast Alloy) Cutter-bits.

Write for NEW S-48 Catalog just released.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

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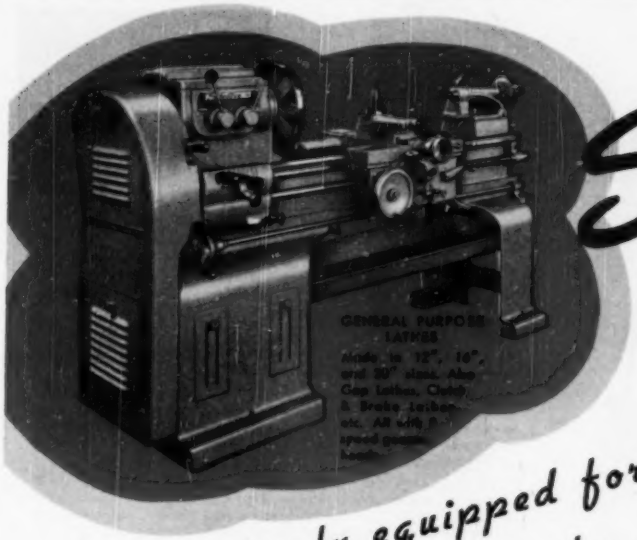
New York • San Francisco



Sebastian GEARED HEAD LATHES

✓ Completely equipped for thorough training
✓ Value leader in the medium-price field

Manufactured By KING — BUILDERS OF WORLD-RENOWNED "KING" BORING & TURNING MACHINES

BIG LATHE FEATURES MAKE THE SEBASTIAN "FIRST IN TEACH-ABILITY"

Following are some of the outstanding superior features of Sebastian Lathes:

TIMKEN TAPERED ROLLER BEARINGS on all shafts in headstock.

OVERSIZED, HEAT-TREATED STEEL GEARS in headstock.

APRON CONTROL for start, stop, and reverse of lathe spindle. (Standard on lathes with 10', 12', and 14' beds.)

REVERSE IN APRON for feeds.

ACCURACY .0005" at every point of alignment.

57 FEED AND THREAD CHANGES.

TAPER GIBS throughout.

AUTOMATIC SPLASH LUBRICATION for all gears in headstock.

LARGE HOLE through spindle.

ALL OF THESE ITEMS ARE SUPPLIED AS STANDARD EQUIPMENT, INCLUDED IN BASIC LATHE PRICE:

MOTOR & WIRING • REVERSING SWITCH • TOOL POST
COOLANT PANS • SPINDLE SLEEVE • CABINET LEG
THREADING DEPTH STOP • LEVELING SCREWS & PLATES
FACE PLATE • DOG PLATE • CENTERS • WRENCHES

In addition to above items, Apron Control and Center Leg are also included as standard equipment on lathes with 10', 12', and 14' beds.

Students trained on a Sebastian Lathe are right at home when they start work in a machine shop. Often they're called upon to operate another Sebastian, widely used throughout industry. And even on big, expensive engine lathes, they find no construction or operating feature essentially different from what they're familiar with in a Sebastian.

Typical is the time-saving Sebastian 2-Station Control—one control at the apron, the other at headstock. The Apron Reverse has operating handle right on the apron. Other outstanding Sebastian features and items furnished as standard equipment are listed at the left.

Built to traditional King standards of quality and precision, the modern Sebastian offers definitely "more lathe for your money." Write today for new Catalog S-1, featuring Standard Type "R" Sebastian Lathes. Make your own comparisons . . . we're confident you'll find the Sebastian best qualified for student training.

American Steel Foundries

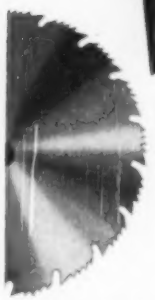
KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

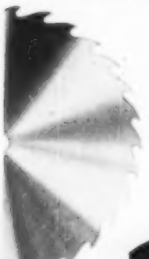
Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

Helps the Pupil... Helps the Teacher

ATKINS "Silver Steel" CIRCULAR SAWS



ATKINS No. 37 Tooth Mitre Saw



ATKINS No. 2 Rip Saw

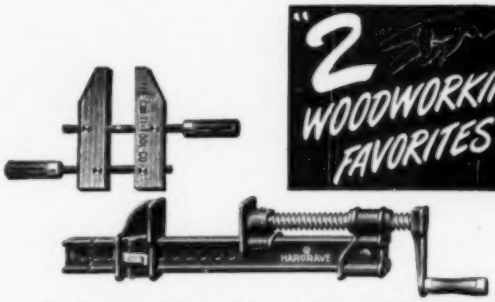
● There's no better way to arouse a shop student's interest than to give him good tools to work with. For example, a saw that cuts clean, fast and true... *an Atkins "Silver Steel" Circular.* Atkins cutting performance helps the pupil learn faster, because he gets good results right from the start. The Teacher's job is made far easier. Atkins help the school budget, too, because of the way their "Silver Steel" holds an extra-keen edge under hard usage. Judged by any standard, it's good practice to specify Atkins.

NOTE: While Atkins manufactures saw blades and tools for every cutting job, it does not manufacture power saw machines. It does, however, furnish blades to many of the leading manufacturers of such machines.

ATKINS

E. C. ATKINS AND COMPANY
Home Office and Factory
402 S. Illinois Street, Indianapolis 9, Indiana
Branch Factory: Portland, Oregon
Branch Offices: Atlanta • Chicago • New Orleans • New York • San Francisco

MAKERS OF BETTER SAWS FOR EVERY CUTTING JOB



"2 WOODWORKING FAVORITES"

IMMEDIATE SHIPMENT!

Hargrave Hand Screws and No. 640 "I" Bar Clamps are favorites of school shops and industrial users.

Cold-drawn steel spindles of the Hand Screw provide long, satisfactory service, jaws are of selected maple. Fluted handles give good grip under all working conditions. Acme thread offers minimum frictional resistance. Openings are from 3 in. to 14 in. Available with adjustable or non-adjustable jaws.

The Hargrave No. 640 "I" Bar Clamp is designed for the hard everyday grind of production. It is rapid and powerful. Notches in web permit quick action, no slipping. Screw is steel, heat-treated to prevent bending or battering of thread. Openings from 2 ft. to 10 ft.

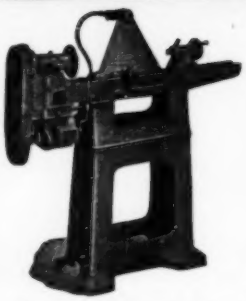
HARGRAVE Tested Tools
THE CINCINNATI TOOL COMPANY

THERE IS AN INDUSTRIAL DISTRIBUTOR STOCK NEAR YOU.

WRITE FOR CATALOG
showing complete line of Hargrave Clamps — from ¾ in. to 10 ft. openings from ½ in. to 16 in. deep.

Waverly & Main Aves.
Cincinnati 12, Ohio

WALLACE
"MACHINE-OF-THE-MONTH"



No. 46 LATHE

Nine variable speeds from 550 to 2400 r.p.m. Automatic - tensioning belt drive. Hardened steel spindle with taper-roller bearings for end thrust. Swiveling headstock for face plate work to 30" diameter.

Here is a lathe equipment of which you can be proud! Sturdy design, precision machining, insures accurate and trouble-free operation. The variable speed drive and heavy-duty headstock invite its use for metal-spinning as well as wood turning.

Swivelling headstock gives unlimited capacity for face plate and center turning work.

Write today for bulletins and prices — we also manufacture quality Universal Saws, Cut-off Saws, Bandsaws, Jointers, Mortisers, Shapers, Oilstone Grinders, etc.

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Easy Adjustments make the CRESCENT BAND SAW

handy for students to operate

Students perform wood-cutting operations quickly and safely with this Crescent machine (32″ and 36″ sizes)

Adjustments are made fast and with little effort, on a Crescent Band Saw. Within easy reach of the student are the table-tilting lock lever, the spring counterbalance, the upper guide bar adjustment, and the starting switches.

Students trained on Crescent Band Saws are "right at home" in industry; their performance is a credit to you. For more than fifty years, woodworking plants everywhere have equipped with Crescent Woodworking Machinery.

Follow the good example of other successful department heads and shop instructors: Specify Crescent Band Saws on your requisitions.

Your nearby Crescent distributor can furnish Crescent Band Saws in three types: Direct motor drive. V-belt drive. Belt drive. And he can supply them on easy credit terms. Ask him for complete details.

Crescent construction features assure safety, accuracy, economy:

- Base is cored casting that is substantially ribbed and braced, to eliminate vibration.
- Metal guard and doors totally enclose wheel assembly, for safety.
- Balanced, accurately-machined metal wheels run true at all speeds.
- Vertical tension adjustment eliminates undue strain and shock on blade, increasing life of blade.
- Front blade guard is adjustable, so that only necessary working surface of blade is exposed.
- Table tilts 45° to right; 5° to left. Easy-to-read scale and pointer.

CRESCENT MACHINE DIVISION
ROCKWELL MANUFACTURING COMPANY
LEETONIA, OHIO

The complete Crescent line also includes Planers . . . Saw Table . . . Shaper . . . Lathe . . . Mortiser . . . Disk Sander . . . Tenoner . . . Jointers (8″-12″-16″)

Use coupon below, to request free copy of Crescent catalog.

TEAR OUT COUPON AND MAIL TODAY!

CRESCENT MACHINE DIVISION
902 Pine Street, Leetonia, Ohio
Send me, without obligation, a copy of the Crescent Woodworking Machinery catalog.

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Position .....
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City ..... (.....) State .....

09-14

NEW DIE CAST ALUMINUM LEVEL

accurately and permanently set vials

$6.30 No. 624—24" die cast aluminum level

Slightly higher in the West
(others 18" to 30" — $5.50 to $7.20)

A level's a level until you look into its quality, durability, utility, design. Then — a level can be a thing of beauty, a tool to help your students project their ever-increasing skill to the precision work they turn out.

Take a new Millers Falls die cast aluminum level in hand. Feel its keen balance and highly polished, precision-ground faces. Note the superb visibility of its white vial wells — how well they're protected by solidly set glasses. Think of the convenience of the two level vials and four plumb vials . . . how long the smooth aluminum die cast frame will last, even with roughest school-shop use.

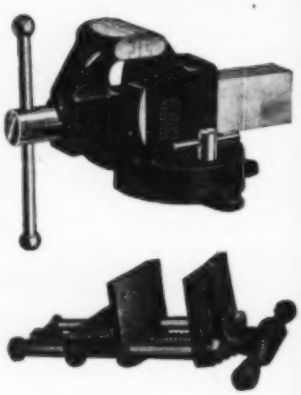
Make you want to equip each workbench with one? See your hardware dealer soon! Millers Falls Company, Greenfield, Mass.

MILLERS FALLS TOOLS SINCE 1868

MILLERS FALLS TOOLS

Let MORGAN *Solve Your* VISE *Problems*

Morgan Vises represent more than a quarter of a century of experience in manufacturing vises. Made of quality materials and exacting workmanship, these vises are ready and able to give the utmost in industry and school shop service.



• Write for Catalog and Prices

MORGAN VISE CO.
100 N. Jefferson St.,
Chicago 6, Ill.

SAW FILING

This ONE Machine
automatically files and joints
HAND, BAND, CIRCULAR Saws

The Foley Saw Filer is ideal for sharpening saws used by students in school shops. It keeps them in tip-top shape, faster and better than by hand filing. Used by Army, Navy, hundreds of manual training departments and industrial plants. The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cut circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner — stay sharp longer. Foley filed saws have less breakage and last longer.

30-DAY TRIAL OFFER

You may have the privilege of using the Foley Saw Filer in your own shop for 30 days. Write or send coupon for details and list of school users.

TYPICAL SCHOOL USERS

Berea College, Berea, Ky.; Board of Education, Cleveland, Ohio; Boys Technical H. S., Milwaukee, Wis.; Charleroi School District, Charleroi, Pa.; Redlands Public Schools, Redlands, Calif.; Stout Institute, Menomonie, Wis.

FOLEY *Automatic* SAW FILER

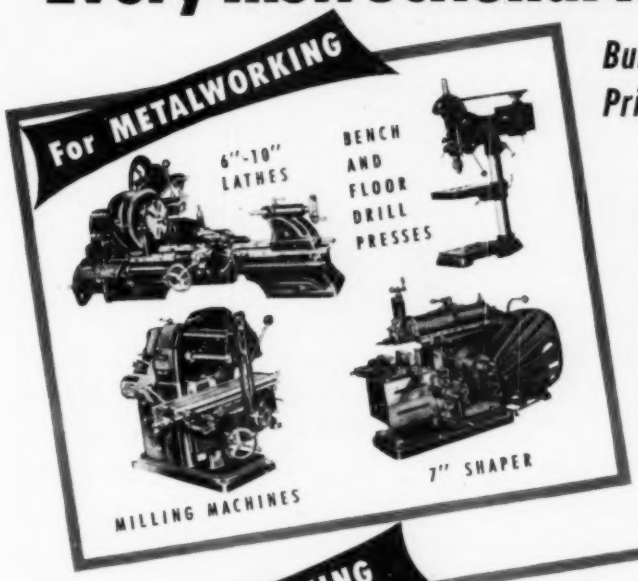
FOLEY MFG. CO., 3318 N.E. 5th St., Minneapolis 18, Minn.
Please send full information on 30-Day Trial Offer and list of school users of Foley Saw Filers.

Name.....

Address.....

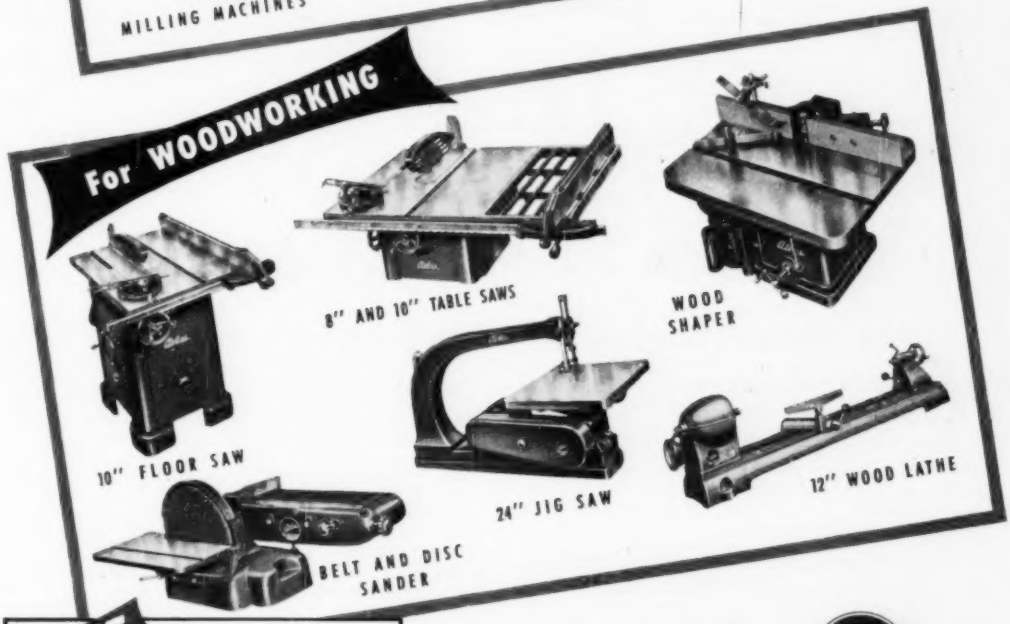
School.....

NOW An *Atlas* Tool for Practically Every Instructional Need In Your Shop



Built to Industrial Standards Priced for School Budgets

When you make up your equipment requisitions this year, keep in mind these low-cost, industrial-quality tools. Atlas now can provide you with tools for instruction in practically every type of operation in metal or wood — ruggedly, accurately-built tools that can stand inexpert student use and give you years of dependable service. Atlas tools simplify instruction — encourage students to make the most of their shop time.



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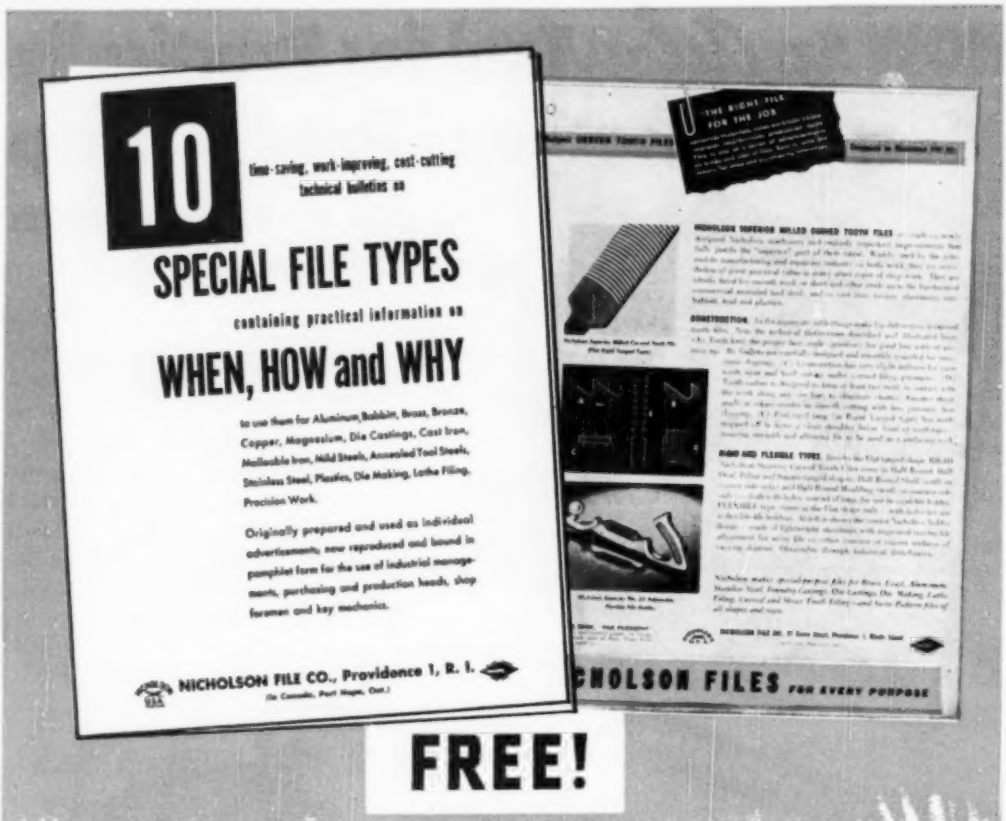
10
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This Issue

The February issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, for some years past, has always been the Testing number. The offering for this month, therefore, is also aimed at giving an impetus to the more extended use of objective testing in our school shops.

Accordingly, tests on woodwork, plastics, electrical work, general shop, mechanical drawing, aeronautics, and leatherwork, have been included. However, the problems and projects section has not been overlooked, and articles on woodwork, metalwork, patternwork, machine shop, and carpentry have been inserted.

There also is a good article on cutting fluids, which the machine-shop instructor may well embody in the related work for his classes.

Our Next Issue

As in previous years, the March number of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION will be dedicated to those who must plan and equip school shops.

There will be shop layouts, course outlines, and articles on shop organization, as well as useful problems and projects.

The equipment and supply lists for metalworking, automotive, electrical, woodworking, print, and drafting classes also may be found quite helpful by some of our readers.

This Month's Cover

The cover picture shown this month presents a logging operation which is common wherever logging is done. The man and his team pictured here, are skidding a large hardwood log near Elk River for the West Virginia Pulp and Paper Company. Photograph by B. W. Muir. Courtesy of U. S. Forest Service.

Coming Conventions

Jan. 16–22. Annual Printing Education Week. This special week is sponsored by National Graphic Arts Education Association, 719 — 15th St., N.W., Washington 5, D. C., in co-operation with the International Benjamin Franklin Society, Inc., and The Franklin Institute.

Jan. 20–23. American Library Association at Chicago, Ill. Headquarters, Edgewater Beach Hotel. Secretary, John M. Cory, 50 East Huron St., Chicago 11, Ill.

Jan. 27–29. American Association of Physics Teachers at New York City. Headquarters, Columbia University. Chairman, H. K. Schilling, Pennsylvania State College, Penn State, Pa.

Feb. 3–4. Pennsylvania State School Directors Association, at Harrisburg, Pa. Headquarters, Penn Harris Hotel. Secretary, P. O. Van Ness, 222 Locust St., Harrisburg, Pa.

Apr. 28–30. Indiana Industrial Education Association, at Turkey Run State Park. Exhibits chairman. Gordon O. Johnson, Shortridge High School, Indianapolis 7, Ind.

Encourage your students to contribute to the March of Dimes, January 14 to 31.

VOL. 38, NO. 2 FEBRUARY, 1949

Industrial Arts and Vocational Education

THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

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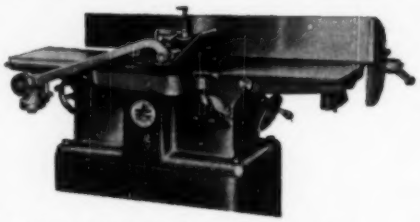

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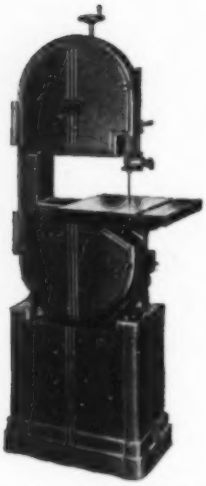

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FEBRUARY . . 1949

Evaluation of Test Results

JOHN A. JARVIS
Assistant Professor
The Stout Institute
Menomonie, Wis.

When tests are given and the results of those tests are used to assign marks, it becomes necessary to evaluate the tests given to ascertain if they are reliable measuring instruments. One of the better methods now available for the evaluation of tests is the analysis of variance. Analysis of variance has been used successfully for many years in other fields, and its many applications to educational problems are now being explored.

To demonstrate test evaluation by this statistical procedure, developed by Hoyt,[1] a real problem is taken as an example. A forty-item, fifty-minute test was given to two classes in freshman electricity at The Stout Institute, containing a total of 42 students. This test with answers appears below:

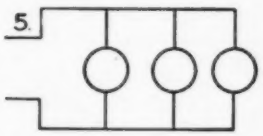
c) 1. An electrical line is transmitting 550 watts at 220 volts, the voltage of the circuit is then lowered to 110 volts, the power being transmitted remaining at 550 watts, the power loss in the line by this action has been (*a*) doubled, (*b*) reduced by ¼, (*c*) multiplied by four, (*d*) none of these.

d) 2. If a wire is 1/16 of an inch in diameter, what is its area in circular mills? (*a*) 62.5, (*b*) 3600, (*c*) 360.0, (*d*) none of these.

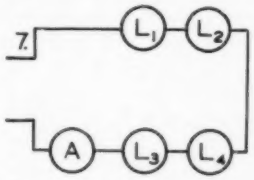
a) 3. If a heating appliance is rated at 1000 watts and draws 5 amperes, what is its voltage rating? (*a*) 200 volts, (*b*) 110 volts, (*c*) 100 volts, (*d*) none of these.

b) 4. A lamp which is rated 30 watts, 110 volts, will draw what current in amperes? (*a*) 3.67, (*b*) .27, (*c*) .37, (*d*) none of these.

a) 5. When the current flowing in the lamps shown is 2, 4, and 8 amperes respectively, what is the total current flowing from the source? (*a*) 14 amperes, (*b*) 1 1/7 amperes, (*c*) 64 amperes, (*d*) none of these.



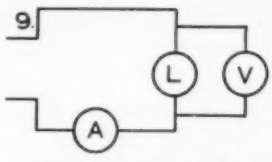
c) 6. If two resistances of 12 and 6 ohms respectively are connected in parallel, what is their total resistance? (*a*) 18 ohms, (*b*) 9 ohms, (*c*) 4 ohms, (*d*) none of these.



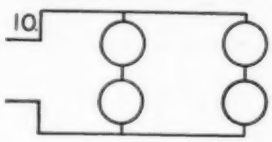
b) 7. When the ammeter in the above circuit reads 1.6 amperes, what current is flowing through L_1? (*a*) 6.4 amperes, (*b*) 1.6 amperes, (*c*) .4 amperes, (*d*) none of these.

c) 8. When two resistances of 5 and 4 ohms respectively are connected in series, what is their total resistance? (*a*) 4½ ohms, (*b*) 20 ohms, (*c*) 9 ohms, (*d*) none of these.

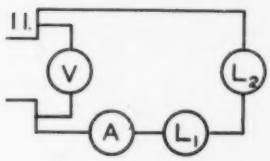
b) 9. The voltmeter and the ammeter are



connected in a circuit with a lamp as shown. If the voltmeter reading is 110 and the ammeter reading .5, what is the resistance of the lamp? (*a*) 55 ohms, (*b*) 220 ohms, (*c*) 110 ohms, (*d*) none of these.



d) 10. If all four of the lamps in the preceding circuit have a resistance of 150 ohms, what is the total resistance of the circuit? (*a*) 600 ohms, (*b*) 37.5 ohms, (*c*) 300 ohms, (*d*) none of these.



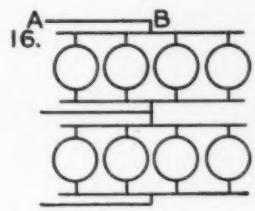
c) 11. When the voltmeter and ammeter are connected as shown, ammeter and voltmeter readings taken, the result of dividing the voltmeter reading by the ammeter reading will be the resistance of (*a*) lamp 1, (*b*) lamp 2, (*c*) the entire circuit, (*d*) none of these.

c) 12. In which one of the following is the formula for power correctly stated? (*a*) $I = \frac{E}{P}$, (*b*) $P = \frac{E}{I}$, (*c*) $I = \frac{P}{E}$, (*d*) none of these.

b) 13. If the voltage and amperage to a motor is doubled the power supplied to the motor will be (*a*) twice as large, (*b*) four times as large, (*c*) half as large, (*d*) none of these.

c) 14. If the output of a generator is 10 kw., its horsepower rating will be (*a*) 75 horsepower, (*b*) 9.2 horsepower, (*c*) 13.4 horsepower, (*d*) none of these.

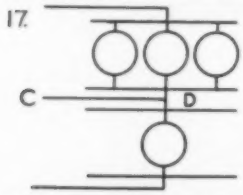
a) 15. In which of the following is ohm's law correctly stated? (*a*) $I = \frac{E}{R}$, (*b*) $I = \frac{R}{E}$, (*c*) $R = \frac{I}{E}$, (*d*) $E = \frac{I}{R}$.



[1]Hoyt, Cyril, "Test Reliability Estimated by Analysis of Variance." *Psychometrika*, Vol. 6, No. 3, June, 1941, pp. 153–160.

a) 16. If in the three wire system shown in illustration 16 each lamp will take 2 amperes the current flowing in AB will be (*a*) 8 amperes, (*b*) 4 amperes, (*c*) 16 amperes, (*d*) none of these.

17.



d) 17. If in the three wire system shown above each lamp takes 2 amperes, the current in CD is (*a*) 6 amperes, (*b*) 2 amperes, (*c*) 8 amperes, (*d*) none of these.

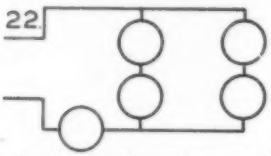
c) 18. If a motor is rated at 5 h.p., and has an efficiency of 50 per cent, the power input to the motor will be (*a*) 2.5 h.p., (*b*) 25 h.p., (*c*) 10 h.p., (*d*) none of these.

d) 19. Is the expression $\frac{E^2}{R}$ equal to the expression IE? (*a*) no, because different symbols are used, (*b*) yes, because $I = \frac{R}{E}$, (*c*) no, because I = ER, (*d*) yes, because $I = \frac{E}{R}$.

b) 20. If the resistance of 200 feet of wire is 10 ohms and the current flowing in this wire is 6 amperes, the voltage drop in the wire will be (*a*) 1 2/3 volts, (*b*) 60 volts, (*c*) .6 volts, (*d*) none of these.

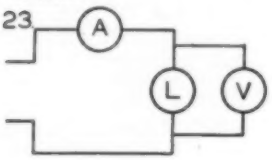
c) 21. A shunt motor takes a total current of 80 amperes at 115 volts and the resistance of the armature is .05 ohms. The resistance of the field is 115 ohms. The current flowing in the armature under the above conditions will be (*a*) 2300 amperes, (*b*) 47 amperes, (*c*) 79 amperes, (*d*) none of these.

22.



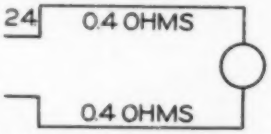
a) 22. If each of the lamps have a resistance of 100 ohms, what is the total resistance of the circuit? (*a*) 200 ohms, (*b*) 300 ohms, (*c*) 500 ohms, (*d*) none of these.

23.



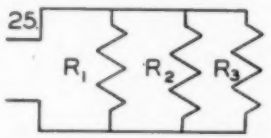
b) 23. In the preceding circuit, the ammeter measures the current flowing in the (*a*) lamp, (*b*) lamp and voltmeter, (*c*) voltmeter, (*d*) wire along.

24.



c) 24. If the current flowing in the wires to the above lamp is 2 amperes, the total line drop is (*a*) .8 volts, (*b*) 2.5 volts, (*c*) 1.6 volts, (*d*) none of these.

25.



d) 25. If $R_1 = 4$ ohms, $R_2 = 6$ ohms, $R_3 = 8$ ohms, and R_1 takes 3 amperes, what is the current flowing through R_2? (*a*) 32 amperes, (*b*) 5 1/3 amperes, (*c*) 4 amperes, (*d*) none of these.

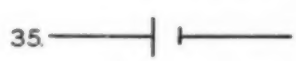
Matching

h) 26. Ohm's Law
c) 27. Electrical energy
f) 28. Amperes
j) 29. Watts
a) 30. Kilowatts
g) 31. Generator outputs
k) 32. Power losses
a) (Amperes)^2 multiplied by resistance divided by one thousand
b) Back voltages
c) Kilowatt hours
d) Horsepower hours
e) Watts multiplied by one thousand
f) Watts divided by volts
g) Kilowatts
h) Volts divided by amperes
i) Lenz's Law
j) Voltage multiplied by amperes
k) Voltage drop multiplied by amperes
l) Amperes divided by volts

33.

34.

35.



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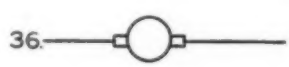

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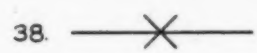

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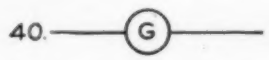

After the test was given and scored, a chart was constructed and appears as Table 1. This chart is constructed by assembling all test papers with the highest score, in this case 39, first; and the lowest, 6 last, with the intermediate scores in their proper order as shown in Table 1. Student No. 1 scored 39 points on the test, and each item he had correct is indicated by a cross in the appropriate item column. The test paper for the second highest score, 37, is now scored across in a similar manner. This process is repeated for the remaining forty members of the class. The individual rows and columns are now totaled and are labeled t_i and p_i. The column t_i and row p_i are totaled and identical results should be obtained for each addition. In this example, 1187 is the sum found. This 1187 is labeled Σp_i and Σt_i. Each t_i and p_i is squared, and the results posted in the column t_i^2 and the row p_i^2. The t_i^2 column and the p_i^2 row are added and the totals are labeled Σt_i^2 (35,577) and Σp_i^2 (38,041). Table 2 is now constructed. The first column in Table 2 is the same for all tests to be evaluated by this technique; the remaining columns must be computed. The second column labeled df indicates the degrees of freedom for each variance. The following formulae are used in computing these items:

Let K = number of individuals, n = number of items.

Degrees of freedom between individuals = k–1 = 42–1 = 41.

Degrees of freedom between items = n–1 = 40–1 = 39.

Total degrees of freedom = nk–1 = 40 x 42–1 = 1,679.

Residual = (n–1) (k–1) = (40–1) (42–1) = 1,599.

The sums of squares are now computed for each source of variance by use of the following formulae:

Sums of squares between individuals

$$= \frac{1}{n}\Sigma t_i^2 - \frac{(\Sigma t_i)^2}{nk}$$

$$= \frac{1}{40} \times 35577 - \frac{(1187)^2}{40 \times 42}$$

$$= 54$$

Sums of squares between items

$$= \frac{1}{k}\Sigma p_i^2 - \frac{(\Sigma t_i)^2}{nk}$$

$$= \frac{1}{42} \times 38041 - \frac{(1187)^2}{42 \times 40}$$

$$= 69$$

ITEMS

STUDENTS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	t_i	t_i^2
1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		39	1521
2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	x	x	x		37	1369
3	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x			x	x	x	x	x	x	x	x	36	1296
4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x			x	x	x	x	x	x	x	x	x		36	1296
5		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	35	1225
6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x		35	1225
7	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x		x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x		35	1225
8	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	35	1225
9	x		x	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	35	1225
10	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x		x		x		x	x		x	x	x	34	1156
11	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x		x	x	x	x	x	x				x	x	x	x	x	x	x	x	33	1089
12	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x		x	x	x		x	x	x	x				x	x	x	x	x	x	x	x	33	1089
13	x		x		x		x	x	x	x	x		x	x	x	x	x	x	x	x		x		x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	33	1089
14	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x		x		x	x	x		x	x			x	x	x	x	x	x	x	x	x	33	1089
15			x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x		x		x		x	x		32	1024
16	x	x		x	x	x	x	x	x		x	x	x	x	x	x	x	x		x		x		x	x	x	x	x	x		x		x	x	x		x	x	x		32	1024
17		x	x		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x			x	x	x	x	x	x	x		x	x	x	x	x	x		x			32	1024
18			x	x	x	x	x	x	x	x	x		x	x	x	x	x	x			x	x		x		x	x	x	x		x		x	x	x	x	x	x	x	x	31	961
19	x	x	x	x	x		x	x	x		x		x		x	x	x	x	x	x		x	x	x	x	x		x	x				x	x	x	x	x	x	x	x	31	961
20	x	x	x	x	x	x	x	x	x		x		x		x	x	x	x		x	x	x	x	x		x	x	x	x				x		x	x	x	x	x	x	31	961
21		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x			x		x	x	x	x				x	x	x	x	x	x	x	x	31	961
22	x	x	x	x	x	x	x	x	x				x		x		x	x		x	x	x		x	x	x		x	x				x	x	x	x	x	x	x	x	29	841
23	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x		x				x	x	x	x	x				x	x	x	x			x	x	29	841
24		x	x		x	x	x	x	x		x			x	x	x	x	x	x		x		x		x	x	x	x	x	x			x	x	x	x	x	x	x	x	29	841
25			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x			x	x		x	x						x	x	x	x	x	x	x	x	29	841
26				x	x	x	x	x	x		x		x		x	x	x	x		x		x		x	x	x	x	x	x				x	x	x	x	x	x	x	x	28	784
27	x		x	x	x	x	x	x	x		x			x	x	x	x			x		x		x				x	x		x	x	x	x	x	x	x	x	x	x	28	784
28		x	x		x	x	x	x	x	x				x	x	x	x			x				x	x	x	x	x	x		x	x	x	x	x	x	x	x			26	784
29			x	x	x	x	x	x	x	x	x		x		x		x			x			x	x	x	x		x			x	x	x	x	x	x		x			25	625
30		x	x	x	x		x	x	x		x	x			x	x	x	x		X				x	x		x		x		x	x	x	x	x	x		x			25	625
31		x	x		x		x	x					x	x	x	x	x		x	x		›	x	x		x		x	x			x	x	x	x	x		x	x		24	576
32				x	x	x	x	x	x		x			x			x	x		x		x			x	x	x	x	x				x	x	x	x			x	x		23	529
33					x	x	x	x	x	x	x		x	x	x	x	x	x				x					x	x					x		x	x	x			x	x		22	484
34			x		x	x		x		x	x			x	x	x	x	x		x	x	x		x		x	x	x	x			x	x						x			22	484
35			x	x	x	x	x					x	x	x		x		x	x							x		x	x	x				x		x	x	x	x	x	x		21	441
36					x		x	x			x				x		x	x		x				x		x		x	x				x		x	x	x	x	x	x		20	400
37									x			x		x	x	x			x		x	x			x		x						x		x	x	x	x	x	x	x		20	400
38				x		x		x		x		x				x	x	x	x					x			x		x					x	x		x		x	x			18	324
39		x				x		x	x	x		x				x				x		x		x			x		x				x		x	x	x	x		x	x			18	324
40						x		x		x		x		x	x		x							x			x		x											x	x	x			17	289
41	x							x				x	x		x	x		x						x			x						x		x	x	x	x	x		x	x		17	289
42							x					x				x	x		x					x																					6	36
																																											Σt_i	Σt_i^2
P_i	20	23	32	27	39	32	39	37	34	22	39	21	30	31	34	31	32	20	34	12	31	13	34	22	37	25	34	33	6	20	19	40	35	39	39	31	32	40	29	ΣR	1187	35577
P_i^2	400	529	1024	729	1521	1024	1521	1369	1156	484	1521	441	900	961	1521	1156	961	1024	400	1156	144	961	169	1156	484	1369	625	1156	1089	36	400	361	1600	1225	1521	1521	961	1024	1600	841	ΣP_i^2		38041

TABLE I TABULATION OF ITEMS ANSWERED CORRECTLY BY EACH STUDENT

Total sum of squares

$$= \frac{(\Sigma t_i)\ (nk - \Sigma t_i)}{nk}$$

$$= \frac{(1187)\ (42 \times 40 - 1187)}{42 \times 40}$$

$$= 348$$

The residual sum of squares is found by subtracting the sum of squares between individuals and items from the total sum of squares.

Residual = total — (between items + between individuals)

Residual = 348 — (54 + 69)

= 225

The mean square column is now computed by dividing each sum of squares by its degree of freedom.

Mean square for individuals $= \frac{54}{41} = 1.316$

Mean square for items $= \frac{69}{39} = 1.77$

Residual $= \frac{225}{1599} = .1408$

SOURCE OF VARIANCE	df	SUM OF SQUARES	MEAN OF SQUARES	F
BETWEEN IND.	41	54	1.316 (a)	9.35
BETWEEN ITEMS	39	69	1.77 (b)	12.60
RESIDUAL	1599	225	.1408(c.)	
TOTAL	1679	348		

Table 2

The mean squares are labeled a, b, and c, as shown in Table 2 and the reliability of the test can be computed by use of the following formula:

$$r_{tt} = \frac{a-c}{a}$$

$$= \frac{1.316}{1.316 - .1408}$$

$$= .893$$

The F column is computed by substitution in the following formula:

$$F_a = \frac{a}{c} \qquad F_b = \frac{b}{c}$$

$$= \frac{1.316}{.1408} \qquad = \frac{1.77}{.1408}$$

$$= 9.35 \qquad = 12.60$$

F_a and F_b are used to determine if the test results are significant. The result needed here for 41 and 39 degrees of freedom[2] is 2.13. Since F_a and F_b are found to be 9.35 and 12.60 it can be said that the test results are significant and can be used in assigning student grades.

Table 1 can now be used for an item analysis. Draw a line splitting the test into two equal halves. Since the scores are in descending order and the total test results are significant, it can logically be said that any item which the lower (poorer) half of the class is more apt to get right than the top, or better half of the class, then that item should be eliminated from the test, or revised, as may seem necessary. The number of right responses for any test item for each half of the test can be determined by counting the crosses. The upper or better half of the class scored higher on each of the forty items of this test. The item analysis can be carried further by finding the percentage difference between each item for the halves of the test and dividing by the standard error of the difference. This process is illustrated below for the first item on the test.

$N_1 = 16 \quad X_1 = 21$ $\qquad$ $N_2 = 4 \quad X_2 = 21$

$P_1\% = \frac{16}{21} = 76\% = P_1$ $\qquad$ $N_2\% = \frac{4}{21} = 19\% = P_2$

$Q_1 = 100 - P_1$ $\qquad$ $Q_2 = 100 - P_2$

$Q_1 = 100 - 76 = 24$ $\qquad$ $Q = 100 - 19 = 81$

$$\text{S.D.}_{\text{DIFF.}} = \sqrt{\frac{P_1 Q_1}{X_1} + \frac{P_2 Q_2}{X_2}}$$

$$= \sqrt{\frac{76 \times 24}{21} + \frac{19 \times 81}{21}}$$

$$= 12.65\%$$

$$\text{DIFF } (P_1\% - P_2\%) = 76 - 19 = 57\%$$

$$\frac{P_1 - P_2}{\text{S.D. DIFF.}} = \frac{57}{12.65} = 4.51$$

If the ratio exceeds 2, or more, the item is said to discriminate. All items having a ratio of less than 2, are revised or eliminated from the test.

This technique, then, provides the following: (1) a means of finding the significance of test scores, (2) a means of computing test reliability, (3) a conveneint form for item analysis that can be used to eliminate or revise unsatisfactory test questions.

Sprinkle salt on icy sidewalks or mix salt with sand or cinders to prevent winter falls.

[2] Lindquist, E. F., *Statistical Analysis in Educational Research* (New York: Houghton Mifflin Co., 1940), p. 62.

The Use of Tests in Retail Education

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In developing tests for use in retail education, teachers are facing many of the same problems that have been the concern of store personnel executives for some years. One of the primary problems in retail education, as in store work itself, is selecting students — or workers, who will be most likely to prove successful on the job. It is only after this selection process has been properly developed that we can go on to the next, testing problems of developing suitable measures of academic accomplishment in retailing courses. Hence, in discussing the use of tests in retail education, an examination of the problems to be faced and the procedures to be followed in selecting employees most likely to prove satisfactory should be the first step.

Which Students Are Most Desirable?

In setting up a testing program which will aid in the selection of students who are desirable and the rejection of those who are not, it is of course necessary first of all to clarify the standards of desirability. Presumably, far more is wanted than scholastic aptitude; it is necessary that the student be qualified by personality and other factors to do well on the job. This qualification requires our investigating the broad and still largely unexplored field of ascertaining and measuring the qualities that make for success in various kinds of retail work.

Fundamentally, this is a problem of scientific research, and it narrows down essentially to finding the answers to these three questions:

1. Who are the good employees and who are the poor ones in each job field?
2. What are the factors which distinguish the good workers from the poor ones?
3. What devices can be used to ascertain in advance which people have the qualities thought to be desirable?

These questions are not new ones; they have been asked in retail employment work and also by some retail educators for many years. There have been many investigations particularly in the field of selling during the past thirty years, with differing conclusions. While some testing workers found that measures of occupational interest were most significant, others placed reliance on the salesperson's gift of words, skill in a completion test, or degree of extraversion. Others believed personality as measured by psychiatric methods to be most revealing. It is necessary to face these questions anew in attempting to develop tests to locate the potentially successful retail workers.

Locating Good and Poor Salespeople

Because training in retailing is so largely for prospective salespeople, it is appropriate in seeking to suggest answers to the foregoing questions above to discuss them in terms of selecting salespeople. The problem, then, is to find some testing device which will supplement the interview to make possible a more reliable selection of *good* salespeople. Tests for sales prospects — and hence for prospective students — can be developed through the use of experimental groups of workers whose good or bad features can be agreed upon. But what are the standards for *success* or *job effectiveness* among retail salespeople? There is much difference of opinion among store executives, customers, and even among salespeople themselves as to the relative merit of various members of a group. Job analysis is useful in defining the nature of the duties to be performed, but it does not provide any complete solu-

tion to the question of who carries out these duties most effectively.[1]

In determining who are the good and who are the poor salespeople, a decision must first be made as to the standard of judgment to be used. Sales effectiveness can be judged on the basis of production data such as net sales, selling cost, ratio of net sales to quota, or some combination of these or other objective factors. If such a measure is used, nonselling duties and special circumstances must be taken into consideration. It is possible also to rate salespeople on the basis of various personal qualities such as initiative, courtesy, and the like. In this case, a rating scale must be devised, and there is the question of who should rate the workers. Finally, there is the possibility of using some combination of both these types of data as a basis for judgment. This inevitably is more complicated and raises the question of the relative weight to be given the various criteria.

The United States Employment Service, which has done much work in seeking to develop tests for retail selling, found that there was little relationship between the ratings of sales production and ratings of personal factors. Similarly, there is a lack of agreement by store executives even as to the relative ratings of the salespeople within a department. Of course, these conclusions further complicate the problem of finding a definite answer, and yet it is clearly impossible to find who the desirable workers are until agreement can be reached.

Finding Some Distinguishing Factors

Assuming for purposes here that it is possible to select salespeople who are good and others who are poor, the next job is to obtain a group to be used for experimental purposes in taking tests and filling out questionnaires. There are statistical difficulties involved here in obtaining a representative sample, and also the morale problem of providing an acceptable answer as to the reason for the selection of those being tested.

What, then, are the factors that relate to the job effectiveness of a retail salesperson? In general, these would seem to fall into two general categories: (1) personal factors including age, number of years of selling experience, education, nationality, and the like, and (2) psychological factors such as mental ability, vocational interests, neurotic tendencies, and memory. There is a virtually unlimited number of factors which might prove to distinguish between good and poor salespeople; and it is always possible that some factor hitherto thought to be unimportant may prove to be one of the distinguishing ones.

A recommended procedure is to select one factor at a time to be measured, and then figure out a means of measuring it. This may be done through selecting a test already prepared, such as one of vocational interest or mental ability, or it may require the time-consuming task of constructing an entirely new test. For the personal data information, it may be possible to measure through a study of application blank data and questionnaire responses, or through personal interviews.

It may develop — as indeed has frequently been the case in earlier experiments — that many of these factors measured do not distinguish in any way between the good salespeople and the poor ones. On the other hand, one or several factors may show up as having a definite relationship to job performance. If after repeated experiments similar results are obtained, then the result can be relied upon for pre-employment predictions. Many testing sessions may be necessary to reach such a definite conclusion.

How Can the Factors Be Measured?

When finally, some basis for distinguishing the good from the poor has been developed, when the method has proved to be statistically correct, and when the results have been shown to hold up under repeated experiment, there will still remain the problem of developing the tests, questionnaires, or other measuring instruments into a form suitable for use with prospective employees, and thus with prospective students. This in itself is a considerable job, and may require much experimental work. There are, of course, many other areas of retail employment that should be investigated in a similar manner.

Current Evidence on Retail Testing

It can be seen that the steps in developing measuring instruments for the selection of desirable students may be a difficult and lengthy process, yet it is an essential one for the retail education field.

What is now being done in an attempt to solve these questions? Just as during earlier years of investigation, there are a number of theories as to the nature of the desirable workers. One school of thought believes that there is a quality *sales ability* or *sales aptitude* which can be isolated and measured, while others believe that sales success comes from a number of factors. There is similarly the argument as to whether or not there is a *sales type* with qualities which fit well into any store and any department, or whether different situations as to merchandise and clientele require varying personal qualities.

There is reason to believe that investigation in the area of various kinds of verbal facility may prove revealing in the identification of good salespeople. Possibly there is a skill which might be called *persuasive fluency*, or less formally defined as the kind of fluency needed in talking oneself into and out of various situations. Perhaps also

A display of representative art metal projects made at the State Teachers College, California, Pa. Submitted by Dr. S. L. Coover

[1]This material is discussed also in the writer's: "Employee Testing," *Business Education World*, Mar., 1947, pp. 400-401.

there is another kind of verbal skill involved in the use and proper selection of words appropriate to selling situations. Since selling is quite largely a matter of oral demonstration, it is not unlikely that skill in using words appropriately may be a strong factor here.

An entirely different area not hitherto examined in any detail is that of attitudes as they relate to effective selling. For example, attitude toward customers, toward management and the job itself, and possibly attitude toward various racial and religious groups may bear some relationship to sales success. In any case, these are possible factors, and experimentation may prove revealing. Scales have been developed for measuring attitude in other areas, and a similar technique may prove effective here.

There is also the possibility that the important factors in selection of salespeople all can be identified in a personal interview that is carefully planned and perhaps recorded for later analysis. Thus it may be that pencil and paper tests would not be needed — though surely there is no conclusive evidence to show that this is true at present.

All of these are merely possibilities not yet fully studied and much work will be required to determine their significance in measuring salespeople.

Consideration in Student Selection

It was mentioned earlier that the problems involved in selecting satisfactory students of retailing were tied in closely with those of selecting retail store employees, and that the procedures described in the foregoing were necessary in developing measuring procedures for both groups. There are, however, several additional considerations that arise in connection with the selection of students. Primarily, there is the question of the relative importance of academic as opposed to vocational aptitude. Ideally, of course, there would be a high correlation between them, and those students who received the high grades in *retail salesmanship* and comparable courses would be most successful as retail workers. Sometimes to the considerable embarrassment of teachers of retailing, however, the relationship may be just the opposite, and the students who seem poorly qualified academically sometimes do the best job in the stores, and vice versa. Thus, the question arises: is a student to be regarded as desirable or successful if he or she receives high grades in classes but does a poor job in the store? Or should we properly consider one to be successful who barely passes in classwork yet is well regarded by employers? There is the further complicating factor that many students do not plan to work for long, and in terms of personal success it is hardly possible to compare objectively marriage and a career in retailing. It is unlikely that any definite answers can be reached to these questions, yet they must be taken into consideration in contemplating the use of testing devices in student selection.

An Experiment in Student Selection

Various attempts have been made through analysis of personal data and test scores to provide some measure of relative student success in retailing. Recently such an investigation was made at the Rochester Institute of Technology, in which the records of a group of outstanding graduates and another group of distinctly unsatisfactory graduates and nongraduates who had attended classes there during the past ten years were studied. The selection of cases for study was made independently by the supervisor of the department of retailing and the faculty member in charge of student employment on the basis of job adjustment and progress in the field. The entrance test records of these former students were checked to discover whether or not there were any significant differences between the good and the poor group. No significant relationship was shown between relative job success and intelligence test scores. On the other hand, as might be expected, there was a high degree of relationship between intelligence test scores and achievement in the various academic courses. Thus there was evidence — confirmed through previous investigations — that we can predict with considerable accuracy academic performance in retailing courses as well as in other subject matter areas. The only reasonably safe deduction that can be drawn here is to be wary of applicants with very high or very low intelligence test scores. Unfortunately, however, we cannot yet predict job success with any assurance, largely for reasons indicated earlier. We have here a tremendous area of needed research by teachers of retailing.

Measuring Student Achievement in Retailing[2]

A further stage in the process of developing a complete testing program is the building of achievement tests for measuring progress in meeting course objectives. Relatively little attention has been given during recent years to the construction of tests of student performance in retailing, as contrasted with more vigorous efforts to improve teaching materials during this same period. Hence, although in many areas the retailing curriculum has been greatly improved, we still do not have the tools for finding out how far a student has progressed in certain directions, we do not know how much he knows about a particular subject or the field as a whole, and we do not generally have the means for identifying his strong and weak points. This situation is much the same in retail stores themselves, and a recent survey of training techniques revealed that few stores have any adequate means of measuring the effectiveness of the training they give new employees.

From the viewpoint of an instructor, a well-constructed series of tests could be of considerable value in improving instruction. The tests could: (1) encourage the instructor to be specific in setting course objectives and to teach in terms of these selected objectives, (2) call the instructor's attention to the weak spots in his teaching, (3) point out specific course areas in which each student is weak, and (4) help the student to know how he is progressing in terms of the job to be accomplished. Tests of a practical nature could be of use also as a method of making store executives more interested in the work being taught.

The Content of a Testing Program

Constructing sound achievement tests in retailing is a detailed procedure that is necessary for efficient teaching, and includes these steps:

1. Analyzing course objectives. It is impossible to know what to test until it has definitely been decided what the course is planned to do. It is particularly important that the objectives be specific ones that actually state the knowledge, skills, and other types of behavior the student is expected to acquire in the course.

2. Collecting test materials. Once the objectives have been clearly stated, a list should be made of the specific points of information and statements of skills the student should acquire in the course.

3. Deciding upon the use of a test. The question next to be decided is how the test is to be used. Good tests can serve a number of purposes, and the desired use or uses should be carefully considered before the test is built.

4. Selecting test situations. The question of what types of test situations should be used can be answered by deciding upon the ways in which students can reveal their knowledge of the objectives being measured.

Obviously, the same types of tests would not be equally suitable for all retailing courses, but in general a desirable achieve-

[2]Achievement testing in retailing is discussed in considerable detail in the writer's articles in *The Journal of Business Education*: "Building an Achievement Testing Program for Retail Training," Oct., 1943, pp. 17–18; and "Constructing Achievement Tests in Retailing," Jan., 1944, pp. 13–14.

ment testing program might appropriately comprise a series of objective or semiobjective tests of four kinds:

1. A general survey examination to be given to beginning students. Such a test would measure in objective form how much a student knows about retailing before taking the courses, and thus would be of aid not only in measuring achievement during the school year, but also in properly placing students both in classes and on the job.

2. Unit tests to measure student progress on the work of one of several units in a single course. These could be brief quizzes to be given at frequent intervals as an aid to students in disclosing current weaknesses.

3. Tests to measure student progress in an entire course. These would be final examinations, and would not necessarily need to be the usual paper and pencil type of test.

4. Comprehensive examinations on an entire subject field. These comprehensives on an entire subject area might be used in part in place of course tests, and could be designed to test whether or not the student can integrate the theoretical course work with practical job experience.

The construction of good tests in retailing — or in any other field — cannot be completed quickly. The setting up of a good testing program, for which the categories above are one suggestion, can more than pay for the work involved, however, through the improvement in instruction it can make possible. Much of what we have yet to learn for the improvement of retail training can be found through evaluation studies, and it is the job of those working in this field to keep informed of testing developments, and to make whatever contributions are possible in adding to the much-needed stock pile of knowledge about what makes good retail workers.

A Method of Test Construction For Shop Subjects

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Most shop teachers have a fairly large and complete file of their subjects, projects, and topics in the fields of their interests that have been gathered over a period of years. However, how many of us have kept a record of the various questions used in testing students with the view in mind to do a better job of teaching?

The writer has used the following method of test construction for approximately three years. Since his interests are in general metalworking and welding his test questions are on the different phases of these subjects.

Each question is placed upon a 4 by 6 in. card. These are grouped as to subjects. This particular file is divided into the following groups:

I. Bench metal
II. Machine shop
III. Sheet metal
IV. Art metal
V. Foundry
VI. Forging
VII. Welding
VIII. Metals (labeled "Metals" for want of a better name). Questions covered are upon source, abundance, uses of metals, metallurgy, etc.

The group is subdivided into the following types of questions:

A. True-false questions
B. Multiple choice questions
C. Completion questions
D. Matching questions

In addition to the number of the group and the letter identifying the type of question, each question is given a number. One might have 50 true-false questions in Group VII. If another is added it would be given the number 51. As questions are added to each group and type, they would be given consecutive numbers.

Therefore each card contains a question, the number of the group to which it belongs, the letter identifying the type of question, and the number of the question.

An index card is placed in the front of the file to aid in the location and return of questions.

#65 Group VII — A
Oxygen will burn.
8 of 17 missed 10–17–47
15 of 20 missed 4– 5–48
#11 Group III — B

If you wanted to make a ¼-in. lock seam on a container, how much material would you allow for the lock seam?

1. ½″ 3. ¾″
2. ⅜″ 4. ⅝″
6 of 20 missed 4–5–48

To use the file all that is required is to go through the cards and select those questions which cover the various phases of work taught. The cards may be placed in any arrangement desired and the questions typed. After the proper length and arrangement of the test is determined the questions may be mimeographed. One copy of the test should be used as a master copy upon which the number of the various questions are recorded. This is to aid in identifying and location of questions for later use.

After the test has been given and scatter diagrams of each question taken, the instructor may see how well his students have done on each item. The results are then recorded on the cards. If 15 of 20 students taking the test missed a particular question this notation is made. If all the students in a class missed a question it may be that the question is poorly written or that the teacher may not have covered the material sufficiently. Questions that all students answer correctly or miss may be reworked if the material, on which they are based, is important enough to warrant this.

Several things can be said in favor of this method of making a test. With questions on individual cards a test can be built in a few minutes simply by pulling the cards wanted, arranging them in order, and typing them up. By keeping records the instructor can see how good a job of teaching he is doing. Questions may be rewritten with ease. New questions may be added to the file or those no longer wanted may be discarded without upsetting or changing the file.

Industrial Arts and Vocational Education

John J. Metz, Editor

THIS TESTING NUMBER

Testing is a necessary part of the teaching process. Without it, neither instructor nor student can definitely say where they have arrived with their respective educational activity. This testing number then is an important reminder coming as it does just before the end of the first semester.

There is, of course, a right way and a wrong way of writing an objective test. It is well to study how such tests are to be constructed, and M. O. Johnson's "A Method of Test Construction for Shop Subjects," on page 47, and J. T. Oldknow's article on "How to Improve Objective-Type Tests," page 49, should be read with more than usual care For those who want to delve into similar articles that have appeared in earlier editions the following references might prove helpful: "Test Forms for Use in Vocational Education," by Donald K. Beckley and Leo F. Smith, page 56, February, 1947, issue; "Constructing Achievement Tests," by Donald K. Beckley and Leo F. Smith, page 52, February, 1945, issue; "Construction of Written Achievement Tests," William J. Micheels and M. Ray Karnes, page 269, September, 1943, and page 307, October, 1943; and "Writing Objective Tests for Shop Instruction," Frank C. Moore and William R. Mason, page 203, May, 1943.

This issue also presents John A. Jarvis' "Evaluation of Test Results," on page 41. Unfortunately, the evaluation step in the testing program is overlooked too often. The article by John A. Jarvis, therefore, deserves careful study.

The tests presented are merely suggestive. Some of the items may not measure up to what is best in test construction, but they represent someone's effort which the reader can recast so that they will better serve his testing purposes.

The part that chance plays when using true-false tests may be overcome at least partially by taking the number right minus the number wrong as the score of such tests. True-false tests also can be made more valuable by requiring the student not only to indicate that certain test items are wrong, but also to show what must be done to make them correct.

In all of this testing it is well to remember that the tests should be more than a mere method of discovering the students that have mastered the subject taught, and those that have not. The test results should also be scrutinized with the idea of discovering how the subject matter of the course can be made more useful in teaching it. Every test should be looked upon as a means of judging both student and teacher.

ADULT EDUCATION

The type of education known by the name in the title of this editorial is by no means new. Many school systems have been offering it for years. Unfortunately, however, there are still many school systems that have not launched their efforts into this fruitful field of educational endeavor.

Much of adult education, in most school systems, will be offered in the evening only. Most adult educational offerings cannot be mere repetition of that which is taught in the school during the daytime, although many of the daytime subjects may serve, at least, as the beginning to get the adult educational work started.

At the outset it may be well to draw the businessmen, industrialists, professional men, tradesmen, workers, and the parents and relatives of the day-school students into the study of the entire problem in order that the venture may be a truly democratic undertaking. In this way the school will receive a better over-all view of what is required, and it will be in better position to give its clients what they want. Both student and teacher then will be in a better position to achieve the aims of adult education.

Teachers, students, and the public must treat adult education on a different level from the courses that are taught during the daytime. It must be treated as something prepared for grownups — not for young students. That does not mean that the work used during the daytime may not be utilized for the evening classes but it must be presented with the idea that the students have arrived at a greater intellectual maturity and must be treated accordingly. Examples must, therefore, be drawn from adult life.

It is for this reason that the planning should not be the work of one man only. It is for this reason also that the evening-school equipment, in some cases at least, must be heavier than that used during the daytime. The evening-school student is a different being from the day-school pupil, and both personalities must be treated in a manner suitable to their own particular needs.

The question also may be asked, how broad should be the offerings that are made to these adult education students. Again a broad planning committee must help settle this question. In some communities where but few trades and occupations are open to the workers (mining towns, and the villages and towns in the oil regions present such conditions), it may be necessary to offer courses along a very narrow selection of special subjects. Under these conditions attempts can be made to create an interest in a number of cultural subjects in order that those living in such narrow environments may get a broader outlook on life.

In other communities where industrial business and professional opportunities are more numerous, courses too can and should be more diversified. Adult education should be looked upon as offering opportunities for all — not just for the few. The needs for this type of education must be seriously studied, not merely guessed at.

THE END OF THE FIRST SEMESTER

The end of any semester always means that some students are ready to leave school to start another chapter in their lives. How well they will play their parts in the new environment, depends partly, at least, on their former teachers.

It is a foregone conclusion that only a very small number of the graduates will turn out to be geniuses. Quite a large number will become average citizens. But there also will be a few who will be anything but good.

Must we, the teachers, take some of the blame for the shortcomings of our ex-students? Could we have helped them to overcome their bad habits?

Now is the time to plan for the next semester. There will be other students who may not be all that they ought to be. Let's plan for them now.

How to Improve Objective-Type Tests

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What measure of the reliability of the informal objective-type test given by shop teachers can be made without resort to involved statistical methods? This is a question which the author had in mind when he made the little study which is reviewed here. Like many well-meaning but busy teachers he felt that formal study of measurement had stressed too much how to compute reliability coefficients and not stressed enough things which are very easily done and which help to assure reasonable reliability before results of administration have been checked. Every teacher knows these things, but there is evidence that they are not known well enough to be useful knowledge, possibly because one of the laws of learning, repetition, has been neglected. Thus this report may serve two purposes: It may serve to point out what is not the best in a number of shop teachers' tests simply by summarizing a tally of characteristics as they were found; and secondly, it may help to make certain facts become useful knowledge by calling attention to them again and supporting them with concrete examples.

The 118 tests to be considered are of the objective type; they are concerned with the industrial or related subjects; and they were all published in the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazine during the ten-year period, 1936–45. The 58 authors came from 21 states, the District of Columbia, Puerto Rico, and Vancouver, B. C. Fully half of them were high school or junior high school teachers of industrial arts as distinguished from vocational teachers.

Coefficients of reliability vary directly with the number of responses required when the test is administered, so it follows that one of the first things that a teacher might consider is the length of his test. Other things being equal a short test may be made more reliable simply by making it longer. Almost certainly half of the tests under consideration were too short unless used with cumulating results. The number of items ranged from 10 to 223 with 60 standing as a median. Twenty-five per cent had less than 32 items, and a maximum of 94 items were found in 75 per cent of the tests. A survey of the authorities would show that this type of test when used for achievement purposes should contain at least 100 items to attain a satisfactory degree of reliability.

Most authorities also agree that directions for recording responses should be included and precede each set of items, and that a complete and correctly marked example, chosen from the subject matter being tested, should be a part of these directions. Of the total, 14 of the tests were published without written directions. Only a third of the remainder included a correctly marked example, and a fourth of these were examples chosen from subject matter completely out of the field. Following is a fictitious but typical example:

(F) Abraham Lincoln was born in Springfield.

Such an example causes a pupil's mind to wander from the subject of the test at hand and may, therefore, affect the reliability of the test.

A consensus of opinion indicates that more than one type of item (i.e., alternate-response, matching, completion, etc.) should be included in a test because various objectives are not easily tested with the same type of item. Testing for factual knowledge might easily be done with a simple alternate-response item, but testing for understanding and ability to apply that knowledge might require the use of the more complicated multiple-choice or problem-situation type of item. Over half of these tests contained only one type of item, and less than a fourth had three different types of items. This could indicate that many of the tests were not testing very many objectives. (Such a criticism is more concerned with the validity of a test which only the teacher is in a position to judge, but it was felt that the situation was worth mentioning because reliability and validity go so hand in hand that they are to some degree dependent on each other.)

Anything which distracts the student's attention affects the reliability of a test score. One such distraction is being forced to jump back and forth from one type of item to the other. This is easily avoided by grouping all similar items and omitting odd types which are too few to justify a separate group. Seventeen per cent of the 58 tests which contained more than one type of item mixed the types indiscriminately. Rearrangement of the items would probably improve the reliability of the test.

Another general characteristic of the tests came under consideration: the specific kinds of items which made up the tests. From a total of 8296 items 43 per cent were alternate-response (either true-false or yes-no). The completion type accounted for another 23 per cent. Both of these types are intrinsically unreliable, the first because it is not very adaptable to testing different objectives and is extremely hard to make unambiguous without making it too easy; the second because it often permits of two or more answers and is often no more than a parroting of textbook or lecture phraseology which tends to weight the odds in favor of the pupil with exceptional memory.

The final general consideration requires that we reconsider all the items by regrouping them into two general types: recognition items and recall items depending on the nature of the response that the pupil is required to make. Analysis of our items in this way shows that 67 per cent of the items are of the recognition type. That is not to say such is undesirable, but if all of a test consists of recognition items, there is the possibility that certain very useful types in the industrial field are being neglected. Some of these are the identification item, the listing or enumeration item, and the situation or problem item.

So far we have been concerned with the tests as whole units. The remainder of this article will be concerned with factors which affect the reliability of a single item. Four types of items — alternate-response, completion, multiple-choice, and matching — accounted for over 86 per cent of the total number of items so these four were chosen for more detailed analysis.

Consider first the alternate-response *alias* the true-false *alias* the yes-no item. It is so called because presumably there are only two possible responses and only one of these is correct. A gambler knows that such odds may not be good but no one is going to lose anything if one can believe the mathematical predictions of chance as derived by erstwhile college professors in the old country many years ago. This 50-50 chance of guessing the right answer naturally has effects on the reliability of the testing instrument. One of today's foremost authorities in the vicious art of building

objective tests gives his pupils 50 per cent score on true-false items which the examinee makes no attempt to answer. Out of 8244 verbal items, 3554, or almost half, were this intrinsically most unreliable type of item regardless of how well it is stated.

Another fault of the alternate-response item which is frequently mentioned by the authorities is the inclusion of specific determiners such as *all, none, never, every, always, entirely, absolutely, exclusively, sometimes, as a rule, and in general.* Items which contain such determiners as *always* and *never* are usually false while items which contain *sometimes, as a rule, and in general* are usually true. Alert pupils are quick to sense this absolute attitude or the noncommittal attitude whichever the case may be and will mark the item on the basis of the determiner used rather than on the basis of what he knows. The total number of alternate-response items were sampled to include some items from all tests containing the type, and 10 per cent of the items were found to contain one of the specific determiners mentioned above.

The second most popular type of item, completion, is more difficult to check for any specific fault which is easily discernible without administering the items, but two check points were applied. The number of words required to fill any one blank should be as few as possible and probably not more than one if the item is to be really objective. This virtue was well practiced in these tests as 94 per cent of the items omitted not more than two words per blank so far as could be judged from the answer keys supplied. Again, for the sake of pupil efficiency and *per se* greater reliability, the blank should be placed near the end of the statement to obviate the necessity for the pupil to read through the statement and then return to the beginning to fill the blank. Examination indicated that 72 per cent of the items placed the blank beyond the center of the statement; but 28 per cent placed the blank in front of the center of the statement, the least advantageous position. Such a fault may be corrected easily by rewording as in the following examples:

The .... joint is the most important joint used in cabinet construction.

The most important joint used in cabinet construction is the .... joint.

.... glue is a stainless glue used in cabinetmaking.

A stainless glue used in cabinetmaking is .....

In both of the foregoing cases, the second statement will save the pupil's time and patience and probably increase the reliability of the test score.

To be most effective the multiple-choice item should probably have at least 4 or 5 responses. It is time consuming to check so many items for plausibility of each of the responses, but the number can be checked rather quickly. In general the items were good in this respect as 67 per cent of the total had 4 or 5 responses. However, it would take little time to eliminate the 5 per cent which supplied only two responses making the item little more than an alternate-response type and subject to the same unreliability.

The number of responses in a multiple-choice item is meaningless if one or more of the confusions is so obviously wrong that a person unfamiliar with the material would recognize the fault. Following are some items taken from these tests which contain obviously wrong and worthless alternatives:

A boring tool has a tendency to spring: (*a*) up, (*b*) down, (*c*) toward the top, (*d*) not to spring at all.

This item contains two answers, *a* and *c*, which are apparently the same which reduces the confusions to three. The fourth confusion, *d*, is grammatically inconsistent (one would not say, "A boring tool has a tendency to spring not to spring at all") and for the alert pupil the chances would thereby be reduced to two or the old, unreliable, 50-50 guessing chance.

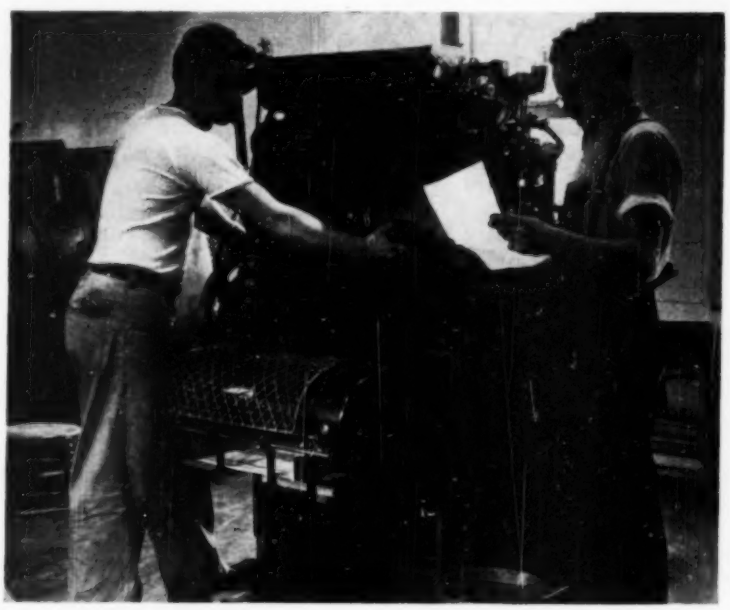
The power hack saw blade may be: (*a*) 6 inches long, (*b*) 8 inches long, (*c*) 10 inches long, (*d*) 14 inches long.

In the second example above use of the permissive "may" would be justification for some students to conclude that any one of the answers is correct, as indeed it might be, dependent only on the saw under consideration.

While working at the lathe one must keep his sleeves rolled up because: (*a*) it keeps them clean; (*b*) it looks better; (*c*) it is unsafe to work with long sleeves; (*d*) the teacher demands it.

The first two confusions in this example would not be likely to tempt a boy any longer than it takes him to read them, and if he considers the last one any longer, the teacher might well check his objectives. About 11 per cent of this type of item was found to contain answers which are not very discriminating even from casual observation.

Matching items, the fourth most popular type in these tests, are also subject to certain characteristics of construction which influence their reliability as testing instruments. These characteristics are easily noted and usually are easy to correct. First, matching sets should contain more statements on one side of the slate than on the other, else the last response will be chosen by elimination. About 40 per cent of the



Offset press in print shop at the University of California, Santa Barbara College, Santa Barbara, Calif. Submitted by E. E. Ericson

sets observed contained an equal number of statements in each column. More than 15 per cent of the sets contained from 10 to 15 extra responses which is a waste of both the teacher's and the pupil's time. Some students will realize this and have a feeling of being required to do busy work which attitude would lead to carelessness and affect the reliability of the score.

Items in matching sets should be homogeneous. Examination of the 42 matching sets in these tests revealed that 59 per cent were not homogeneous to some degree, and many of them could be matched correctly with very superficial knowledge of the subject matter. For example:

The *number* of inches represented by 3′ 9″.	*45*
The *part of a drill* press used to clamp the bit.	*chuck*
The measure of the unit of resistance in *electricity*.	*ohm*
The material used to cover the pithy places and knots before *painting*.	*shellac*
The groove or *saw cut*.	*kerf*

The words in italics alone are sufficient for matching purposes, and the extra words merely favor the verbally wise student; but more important all the answers are pretty obvious. There is only one number in the right-hand column so *45* must be the correct answer. There is only one part of a drill press and only one electrical term. There is only one material involved in painting or wood finishing operations. Such an item is unreliable because it is apt to discriminate on some basis other than achievement.

Another example of an item which is lacking in homogeneity:

The chief iron and steel center of the South.	Birmingham
The metal in a light bulb filament.	tungsten
The voltage of the common light bulb circuit.	110

The first statement requires only that one find the name of a town; the second calls only to distinguish a town from a metal; and the third calls for a number. Such an item may be made more dependable if several statements are made which require the names of cities as answers, several which require the names of metals, and several which require numbers. Then each type of response may be grouped in a separate set or matching exercise.

To summarize, 118 tests by shop teachers from widely scattered locations were examined in general as whole tests and in particular as individual items. In general the tests contained too many alternate-response items in face of the fact that the type is often held in disrepute and seldom appears in carefully made standardized tests. Many of the tests could be made more reliable by the addition of more items, and by the addition of correctly marked examples from the subject matter being tested. A few of the tests could be improved by grouping similar types of items. The recognition type item appeared more popular, but there is reason to believe that as a reliable measuring instrument, it is often inappropriate.

Four individual types — alternate-response, completion, multiple-choice, and matching — accounted for 86 per cent of the total number of items. Multiple-choice ranked low in face of the fact that it is generally the most reliable and most applicable type. The most unreliable type, alternate-response, was found to contain specific determiners in one out of ten cases. Many completion items could be improved by rewording to place the blank at the end of the statement. The number of choices in multiple choice items was often meaningless because some of the choices were obviously wrong. Some matching sets could be improved by adding one or more extra responses, and some could be improved by reducing a large number of extra responses to one or two. Many matching sets lacked homogeneity to an extent that correct answers could be chosen with only superficial knowledge of the subject matter.

If one wishes to be reasonably sure that an informal objective-type test will have some degree of reliability, at least in so far as it can be easily and quickly checked, a list like the following might be applied to each test before it is administered:

General considerations:

- Length (at least 100 items)
- Directions — for each type of item correctly marked examples
- Variety of item types (to suit objectives being tested)
- Items of a type in separate groups

Specific considerations:

- Alternate-response
  - Overuse
  - Specific determiners
- Completion
  - Length of omissions
  - Position of omissions
- Multiple-choice
  - Number of confusions
  - Plausibility of confusions
  - Grammatical consistency
- Matching
  - Unequal columns
  - Homogeneity in sets

Methods of Teaching Occupational Subjects*

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(Continued from page 12A of the January, 1949, issue)

The Test Step

The last step in the 4-step lesson is the *test step*. The purpose of this step is to determine whether the student has performed the operation satisfactorily. This, on the surface, may appear simple, but it is not. It immediately raises the question as to what constitutes satisfactory performance. It is generally agreed that satisfactory performance of the student in the application step should be based upon the following:

1. *The quality of the work.*
2. *The quantity of the work.*
3. *The technique employed by the student.*

We are not going to discuss the method of assigning a grade to the student's performance of the application step because this would require a discussion of considerable length. The assignment of grades is a subject in itself and it should not be included in the test step of the 4-step lesson. When the shop instructor tests the work of the student, he decides whether or not the work is of satisfactory quality; that is, are the holes smooth enough and are the holes spaced according to specifications. If the answer is yes, the student has completed the lesson; but if the answer is no, then the student should perform the operation again.

*Previously published parts of this serial have appeared on p. 88 of the Mar., 1948, issue; p. 144, Apr., 1948; p. 220, June, 1948; p. 312, Oct., 1948; p. 363, Nov., 1948; and p. 40, Jan., 1949, issue.

To check the quantity of the work, the shop instructor checks the time consumed by the student to perform the operation and decides whether or not the student has performed in satisfactory time. This must be decided by the shop instructor. If he feels that the performance should require two hours and thirty minutes and the student consumes four hours, then, surely, the time of performance is unsatisfactory. The student should be told that he consumed too much time, and this should be considered in making up his grade, but he should not be required to repeat the performance as part of the lesson. The student will be drilling holes many times after his first performance, but subsequent performances are not part of the 4-step lesson. They are assigned to increase the student's skill in drilling holes.

Finally the student's performance is checked as to the techniques employed during the application step. The instructor decides whether or not the student used the correct techniques in his performance. If we recall, the correct techniques to employ were put over during the presentation step. The instructor decides whether or not the student followed the correct techniques in his performance. Now, the shop instructor cannot decide simply by looking at the finished product. This can be done only by observation of the student's performance. This does not mean that the shop instructor must stand by the student during the entire performance, but it does mean that observations should be made from time to time. Sometimes this point is neglected, but if the student realizes that he must follow the techniques put over in the presentation step, he will, no doubt, make an effort to absorb the techniques used by the instructor in the presentation step.

The test step is an appraisal step. It is not part of the application step. The shop instructor should test the quality and quantity after the performance is completed. The student's technique is observed during the application step, *but it is appraised during the test step.*

The Lesson Plan

To put over a shop lesson for plain drilling flat work (series of holes same size), the shop instructor should have the following:

1. A machine-shop job analysis for this lesson
2. The operation sheet for this lesson
3. The lesson plan for this lesson

The machine-shop job analysis for this lesson has already been explained. It forms the basis for the operation sheet and the lesson plan. The operation sheet for this lesson has also been explained. This operation sheet is developed from material in the machine-shop job analysis, and it is used in the application step by the student.

The lesson plan is the blueprint of the 4-step lesson on plain drilling flat work (series of holes same size). It shows exactly what the instructor is going to do in the preparation, presentation, application, and test steps. Since we have developed the plan of each step during the discussion of the four steps, to develop our lesson plan, we simply assemble the plan of procedure outlined in the discussion of the steps. The resulting lesson plan follows:

The foregoing lesson plan is the blueprint for the lesson in plain drilling flat work (series of holes same size). It shows what the instructor will do in each step of the 4-step lesson. It should be noted that the lesson plan shows no questions in the presentation step, nevertheless, the instructor must use questions in this step if he intends to use the developmental line of approach, but it is not good practice to show these questions in the presentation step of the lesson plan for the simple reason that the instructor will vary the questions, depending upon the student interest.

LESSON PLAN

Block IX Vertical Drill Press **Unit E**

Aim: To teach how to drill a series of holes (same size) in a flat plate.

Tools, supplies, equipment: vertical drill press, taper shank drill, clamps, bolts, shims, wrenches, small gauge, center punch, hammer, oil can — coolant, bench brush, flat plate.

Preparation Step — Demonstration Method

1. Supervise assembly of class at bench.
2. Clamp wood in vise. — 2. Why do we clamp the wood, John?
3. Insert bit in brace and tighten.
4. Place point of bit against wood at center of hole to be drilled.
5. Drill hole. — 5. Why do we apply pressure against the brace?
6. Remove bit from hole.

Presentation Step — Developmental Line of Approach

Operation Steps	*Information Points*
(a) *Mounted on table*	
1. Clamp work on parallels.	1. Sleeves, rings, neckties, clamp securely.
2. Center punch all layout centers.	2. Check layout, center punch each hole to start drill.
3. Insert drill.	3. Check drill size.
4. Set speed and feed.	4. Drill speed $\frac{4S}{D}$ = r.p.m.
5. Unlock table and position it approximately.	5. Use care in pulling over table.
6. Start machine.	
7. Advance drill by hand; take trial cut.	7. Depth of trial cut.
8. Pull table over if necessary.	8. Recenter punch.
9. Lock table, lock feed.	
10. Drill through work.	10. Do not drill into table.
11. Repeat 5, 7, 8, 9, 10, for remaining holes.	

Application Step

1. Pass out operation sheet.
2. Supervise the student's performance.
3. Ask questions to straighten out student if he runs into difficulty.
4. Check on the effectiveness of the teaching.
5. Reteach if necessary.

Test Step

1. The quality of the work.
2. The quantity of the work.
3. The technique employed by the student.

Some Leaders in Industrial Education

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(Continued from page 11 of the January, 1949, issue)

Dr. L. D. Harvey and The Stout Institute (Concluded)

A State Institute

Following Mr. Stout's untimely death there was a period of uncertainty as to the future of The Stout Institute. Although there was no will, there was no uncertainty as to Mr. Stout's purpose with reference to continued maintenance and expansion.

In due time Mrs. Stout offered to deed The Stout Institute, free of all encumbrances, to the state of Wisconsin. The only condition attached to the offer was that the state should assume the payment of the annual deficit, which for several years had amounted to approximately $25,000. This deficit, as we have already noted, had been defrayed each year by Mr. Stout. The proposal was laid before the legislature in January, 1911, accompanied by a detailed inventory showing assets valued at approximately $500,000.

The legislature appointed a special committee to visit and inspect The Institute, its buildings, equipment, and program, and to report with recommendations. In its report the committee urged the acceptance of the offer made by Mrs. Stout and the trustees of The Institute, and recommended that a plan of control be set up that would insure the continuance of a program along lines substantially similar to those followed theretofore. The committee recommended further that The Stout Institute should continue its independent status, and should not be made a part of, or subordinate to, or in any way placed under the control of any other institution or board in the state.

The recommendations of the committee appealed strongly to the members of the legislature, and they were adopted practically without change. The legislature evidenced complete confidence in the soundness of Senator Stout's educational vision as well as in the practical and statesmanlike quality of Dr. Harvey's leadership. With only five dissenting votes the legislature, on June 28, 1911, passed the enabling act, which was signed by the governor a few days later.

Under the stimulus of Senator Stout, as chairman of the senate committee on education, and supported by the findings of several investigations conducted or promoted by Dr. Harvey, while state superintendent of public instruction, and other influences, the legislature had been for several sessions considering the establishment of a state system of industrial schools. The act of June 28, 1911, combined provision for the control and management of The Stout Institute with provision for the inauguration of a state system of vocational education. This sketch is concerned only with those provisions of the act relating to The Stout Institute.

The act provided that The Institute should come under state ownership, and that its control and management should be vested in the newly created State Board of Industrial Education. While acting in this capacity, the state board functions as the board of trustees of The Institute.

The act provided for a waiting period of two months, to afford the outgoing board of trustees and Mrs. Stout time in which to prepare the necessary papers and to turn over the property of The Stout Institute to the state of Wisconsin, with the buildings in good repair, and free of all incumbrances and claims.

The new State Board of Industrial Education, created by the Act of June 28, 1911, was to consist of six members, appointed by the governor. Three members of the board were to be employers of labor, and three were to be skilled employees. The state superintendent of public instruction was to be ex officio chairman of the board. In addition, the dean of the college of engineering and the dean of the extension department of the University of Wisconsin were to be ex officio members of the board.

The cost to the state of Wisconsin for the maintenance and operation of The Stout Institute for the first biennium under state management, 1911–13, was approximately $20,000 annually. The remainder of the operating budget was made principally from tuition and other fees paid by the students.

Appropriation for New Building

In 1913, the trustees determined to request the legislature for an appropriation for needed new buildings in order to provide accommodations for the increasing enrollment of students. Dr. Harvey was requested to prepare a statement to be submitted to the legislature setting forth the need of the new buildings.

In this statement Dr. Harvey reviewed the growth of The Stout Institute, and showed that the buildings and equipment were designed, in 1903, to accommodate 200 students, but that in 1913 the attendance was well over 500, with many prospective students on the waiting list because of lack of facilities. To illustrate the pressure of prospective students, the advanced enrollment for 1912–13 reached the limit of capacity and further enrollment was discontinued as early as February, 1912. After the waiting list was closed, 100 additional direct applications were received, and over 600 letters of inquiry of which an unknown number would certainly have eventuated in enrollments with a little encouragement.

Dr. Harvey stated, further, that Mr. Stout's plans were well developed, in 1910, for the purchase of additional land, and for the erection of another much needed building which was expected to cost $200,000. These plans were not carried out because of Mr. Stout's death.

The members of the legislature were very favorably impressed by the report of the work being done at The Stout Institute, by the convincing statement of the urgent needs for the immediate future, and especially by the effective pleas made by Dr. Harvey in his appearances at hearings held by the committees on education of the two houses. In April, 1913, a bill passed both houses with hardly a dissenting note appropriating $265,000 for the erection of two buildings, one for home economics and one for the trades school.

The architects proceeded with plans for the two buildings, but actual construction was delayed by Governor Francis E. McGovern, who announced early in the spring of 1914 that the erection of certain buildings for which the legislature had made appropriations (including the two buildings for The Stout Institute) would be postponed until after July 1, 1915, because of the public clamor for retrenchment in state expenditures. In pursuance of this policy the governor appeared before the board of trustees

and persuaded the board to adopt a resolution favoring the postponement.

However, a citizen of Menomonie instituted a suit against the state board, challenging its competency to take such action. The case was finally decided in the state supreme court, which ruled that the board was without authority to pass such a resolution, and required the governor to rescind the order and to release the funds as appropriated by the legislature. Shortly after this the funds were made available, and construction of the buildings was begun in the summer of 1914.

Struggle for Expansion

With the growth of the manual training movement throughout the United States, and, more especially, with the higher standards demanded in secondary schools, it was evident that further changes and improvements must be made at The Stout Institute to enable it to meet the new demands for teachers.

Several states in the Middle West had, several years before this date, raised the State Normal Schools to the status of Teachers Colleges, with authority to grant baccalaureate degrees. For example, Illinois took this step in 1908–09. However, The Stout Institute, and the nine State Normal Schools (Eau Claire, La Crosse, Milwaukee, Oshkosh, Platteville, River Falls, Stevens Point, Superior, Whitewater) were offering curricula only two years in length, leading to teaching certificates.

In 1916–17, the board of trustees requested President Harvey to draw up proposals authorizing The Stout Institute to extend its curricula to four years, and to award the baccalaureate degree. A bill incorporating these recommendations was introduced in the state legislature in the spring of 1917.

As it happened in most other states, the proposed legislation drew immediate opposition from the presidents of colleges, and even from the State University. President Van Hise of the University of Wisconsin took the lead in opposing the move. Similar opposition had effectually blocked three previous efforts in the legislature to raise the standards of the State Normal Schools, in 1909, 1911, and 1913. But in 1917 there was more aggressive action under the leadership of Dr. Harvey.

In hearings before committees of the legislature, Dr. Harvey refuted the various objections raised by the opposition. Following is a digest of the most important objections enumerated in a brief drawn up by President Van Hise and those associated with him, and the rebuttal.

1. The Stout Institute is an institution for the training of teachers; it should remain so; this is a move to make of it another college of liberal arts, which Wisconsin does not need. Answer: The bill specifically defines the objectives of the institution as the preparation of teachers of industrial arts and household arts, and includes no provision authorizing the organization of a college of the liberal arts type.

2. Facilities and opportunities for higher education would be duplicated unnecessarily. Answer: The bill proposes nothing in the field of higher education except the preparation of teachers of industrial arts and household arts. Only two institutions in Wisconsin offer four-year courses for training these teachers: University of Wisconsin for industrial arts and household arts, and Downer College for household arts. Evidently the amount of duplication would not be excessive.

3. If this request be granted, it will be followed by a move to make similar changes in the nine State Normal Schools. The legislature should not embark on such a radical and expensive reorganization of the state educational system. Answer: Notwithstanding the fact that 150 of the leading high schools of Wisconsin had adopted the policy of employing only four-year college graduates as teachers, The Stout Institute furnished 32.3 per cent of all industrial-arts teachers in the state, whereas the University furnished only 6.6 per cent. If The Stout Institute is to continue to do the work it was organized to do, it must extend its courses to meet the demands of the high schools. The state cannot afford to permit this school, with the best equipped plant in the United States for its special type of work, to close its doors.

It should be added that there was only a minimum of justification for the institutional jealousies and fears of encroachment that embittered the educational world. Students of the history of education will recall that other states passed through similar struggles. Statistical studies made during the period showed that, in the cases of most colleges and universities, 70 per cent or more of the student enrollment was furnished by the county in which the institution was located and the immediately surrounding counties. The distribution of student enrollment has undoubtedly changed in recent decades, with increased ease of mobility, and the influence of other factors. The recent phenomenal growth of the junior college movement seems to furnish additional evidence to indicate that if there is to be further increase in the proportion of the population enjoying the benefits of higher education, the facilities must be brought closer to the homes of prospective students.

A State Teachers College

The outcome of the struggle was the enactment by the state legislature, by an overwhelming vote of both houses, of a law authorizing The Stout Institute to extend its curricula to four years in length, and to award baccalaureate degrees to qualified graduates of the approved four-year curricula in industrial arts and household arts. By this act of the legislature The Stout Institute was raised to the status of a State Teachers College.

The Stout Institute justly claims to be the only institution of its kind in the United States, the sole purpose of which is the professional preparation of teachers, supervisors, and directors of

No. 2 LeBlond cutter grinder at American Lava Corp., Chattanooga, Tenn., Operator is Garrette L. Hitchcox, Dunlap, Tenn.

industrial arts and household arts. For the discharge of these functions the physical plant now consists of the industrial education building, the home-economics building, the trade school building, and the gymnasium. In addition, there are several dormitory buildings, a practice cottage, and an infirmary. The entire plant represents an investment well in excess of $1,000,000.

World War I Activities

Mention must be made of Dr. Harvey's contribution to World War I. As an intensely patriotic, not to say militant American, he occupied a prominent place in the public life of Wisconsin during the war years. He was promptly named chairman of the Dunn County Council of Defense. In this capacity he prepared a comprehensive plan for the organization of the entire county. A local council was organized in every incorporated community in the county and in most of the smaller places. Letters of instruction and advice went out regularly to members of district, village, and city boards of education, to the chairmen of all local committees, and to every teacher in the county. Meetings were held in all parts of the county, and many of these meetings were addressed by Dr. Harvey himself.

During the war period Dr. Harvey was in constant demand as a speaker, not only in all sections of Wisconsin but in near-by states. He continually advocated support of the government and the war effort, and denounced pacifists, shirkers, and the disloyal elements. He enlisted the services of many prominent speakers, some of whom made trips lasting a week to ten days. Under his direction lists were made of owners of automobiles who agreed to furnish their cars for emergency service upon the call of the County Council of Defense or of any local Council.

With this plan of organization and transportation it was possible for Dr. Harvey and his committee to canvass the county thoroughly and expeditiously wherever it was necessary to conduct one of the drives for funds. Without exception, Dunn County exceeded its quota in every drive undertaken. "Dr. Harvey personally led one of the most successful Red Cross drives conducted in any part of Wisconsin." Under his direction the young people of Dunn County raised thousands of dollars' worth of vegetables in school and home gardens, and turned the money into Junior Red Cross funds.

Young women in the home-economics department of The Stout Institute were given instruction and practice in Red Cross work, and young men in the industrial-arts department were given instruction in military science and military drill. Elective courses were offered in food conservation and food preparation. "As a result of these and other special courses, The Stout Institute furnished more dieticians for hospitals during the war than any other institution in the United States."

A Versatile Leader

All the available accounts of Dr. Harvey's career emphasize his versatility. Not only was he a great educator, both as teacher and administrator, he was a powerful and influential speaker on a great variety of subjects. His interest and activities were by no means confined to the schools. He read extensively and thoroughly and maintained a strong grasp on the affairs of the day. A wide fund of information enabled him to hold his own in any situation.

He had an unusual faculty for the business problems that are so important in the conduct of any school system. His associates expressed the conviction that had he chosen a business career he would have achieved distinction in that field and probably great wealth. His liking for business resulted in his becoming associated with the Bank of Menomonie, which he served as president for many years.

Professional Organizations

As previously noted, Dr. Harvey was always active in professional organizations of teachers. Among the more important of these activities may be mentioned the following:

Throughout his entire career as an educator he was an active member of the Wisconsin State Teachers Association, serving as president in 1890–91, and as a member of numerous committees, including many years as a member of the influential legislative committee.

He was also for many years active in the National Education Association, serving one term as vice-president, 1897–98, and one term as president, 1908–09. He was also a life director of the Association.

He served one term, 1898–99, as president of the Department of Superintendence of the National Education Association, now the American Association of School Administrators.

He served one term as president of the Department of Libraries of the National Education Association.

He was the author of a series of arithmetics for use in elementary schools, and many educational reports, addresses, and magazine articles.

Committee on Publicity

For more than two years, beginning in 1919, he served as chairman of the Committee on Publicity of the Wisconsin State Teachers Association, in which capacity he planned and directed a campaign of education throughout the state. The purpose in view was improvement in conditions in the public school system. Among the accomplishments of the campaign were better buildings and more and better equipment, more adequate compensation for teachers, and higher standards of teaching both in methods and in personnel. The activities of the committee were influential in promulgating the conviction that the education of children is the most important business of the state and that the pupils enrolled in the schools deserve the best that can be given them.

For many years Dr. Harvey was in wide demand as a lecturer on industrial education and other phases and problems of public education. The National Council of Education named him chairman of a committee to investigate and report on the possibilities of industrial education in rural communities. This report was completed and submitted in 1905. A short time later the state legislature of Wisconsin commissioned Dr. Harvey to make a similar study and report for that state.

As evidence of the high regard in which Dr. Harvey was held by the educators of Wisconsin was the movement, in 1921, to place in the office of the state superintendent of public instruction, in Madison, a life-size portrait. The commission to paint the portrait was given to Christian Abrahamson, a noted artist, and the likeness now hangs in the state capitol, a tribute such as has been accorded no other Wisconsin teacher.

In the prospectus relating to this project the committee in charge included the following statement:

"One of the greatest characters in the educational work in Wisconsin is Lorenzo Dow Harvey, now president of The Stout Institute.

"It was just 55 years ago — 1866 — when L. D. Harvey began his educational career in Wisconsin as a district school teacher. From that day to this he has been a living, vital factor in shaping the destiny of our educational system. His aggressive, constructive labors have been recognized far beyond the boundaries of the Badger State. The value of his contribution to the growth of Wisconsin schools cannot be estimated in mere dollars and cents."

References

In addition to other sources, I have made particular use of the following references, for which I wish to express my indebtedness and appreciation.

Scrapbook of newspaper clippings relating to Dr. L. D. Harvey, Senator J. H. Stout, and The Stout Institute, loaned from the Mabel Tainter Memorial Library, Menomonie, Wis., through the courtesy of Mrs. Essie C. Nickerson, librarian:

Edgar G. Doudna, "The Making of Our Wisconsin Schools," *Wisconsin Journal of Education*, Vol. 80, No. 5, January, 1948, pages 219–250.

Lorenzo D. Harvey, Wisconsin's Educational Reformer, an unpublished biography, by C. E. Patzer, one time city and county superintendent of schools, Manitowoc County, Manitowoc, Wis., and member of the faculty of the State Normal School, Milwaukee, Wis., during the period of Dr. Harvey's presidency. Loaned from the library of the State Board of Regents for Normal Schools, Madison, Wis., through the courtesy of Edgar G. Doudna, Secretary.

Charles A. Bennett, *History of Manual and Industrial Education*, 1870 to 1917, Chapter 12, Teacher Training and Associations of Teachers, pages 464–506 (Peoria, Ill.: The Manual Arts Press, 1937).

(To be continued)

Testing and Tests

CABINETMAKING TEST — RELATED WORK, SECOND TERM

W. H. BOWERS
High School
Tuckahoe, N. Y.

Part I

The following test is given to ascertain your knowledge concerning the related work connected with cabinetmaking.

Part I pertains to related work only.

Part II pertains to tools and materials, wood finishing and power machines.

Part III pertains to an industrial survey.

If you think the statement is correct place a *T* before the question; if you consider it false place an *F* before the statement.

( ) 1. The lumber industry ranks first in America's producing agencies.
( ) 2. The lumber industry is the most efficient, in regard to modern methods of production.
( ) 3. Logging and lumbering represent an invested capital of over two million dollars in this country.
( ) 4. There are approximately 10,000 sawmills in this country.
( ) 5. There is no danger of a timber famine in the United States, at present.
( ) 6. The cabinetmaker of today does mostly handwork in a furniture factory.
( ) 7. The furniture produced today commands a higher price than that made years ago.
( ) 8. Full size mechanical drawings are used in the furniture factories.
( ) 9. The designer of furniture is perhaps the most important individual in a furniture factory.
( ) 10. Stock of irregular shape is cut out on the band saw in a factory.
( ) 11. The band saw operator operates the mortise-and-tenon machines and band saw in a modern factory.
( ) 12. The finishing in wood factories is done in a separate department.
( ) 13. Mahogany and walnut wood are used mostly for veneering in factories.
( ) 14. Most of the work done in a factory is classed as semiskilled.
( ) 15. There is much heavy lifting and excessive strain involved in cabinetwork.
( ) 16. The demand for skilled labor in the cabinet trade is constant.
( ) 17. It takes only a short time to become a skilled machine operator in a wood factory.
( ) 18. The patternmaker is often called "the aristocrat of woodworkers."
( ) 19. The patternmaker must understand mechanical construction.
( ) 20. A patternmaker's work is very dangerous.
( ) 21. The patternmaker is well paid for his work.
( ) 22. The patternmaker must serve a four years' apprenticeship.
( ) 23. The finest work in the carpenter trade is framing.
( ) 24. Specialization has not affected the carpenter to a great extent.
( ) 25. The work of the carpenter is very monotonous.
( ) 26. The active career of a carpenter is from 15 to 20 years.
( ) 27. A boy upon graduation from a vocational school is accepted in the trade as a carpenter.
( ) 28. The work of a carpenter is affected by the seasons of the year.
( ) 29. The carpenter trade offers the competent boy very good opportunities for advancement.
( ) 30. A knowledge of "wood" gives a boy scientific facts useful in his later life.
( ) 31. Trees are divided into four groups.
( ) 32. The pine tree is a member of the conifer group.
( ) 33. The broad leafed trees shed their leaves every six months.
( ) 34. Oak, mahogany, and maple are broad leafed trees.
( ) 35. The palm and bamboo trees furnish most of the wood used in building construction.
( ) 36. The bamboo tree grows along the Atlantic Coast.
( ) 37. A tree consists of three main parts, the crown, the roots, and the trunk.
( ) 38. Water and minerals are first taken up by the roots of the tree.
( ) 39. The trunk is the most important part of a tree.
( ) 40. Milk, eggs, meat, silk are indirectly obtained from plants.
( ) 41. Enormous quantities of lumber are wasted annually.
( ) 42. Nothing is being done to eliminate the waste in lumber production.
( ) 43. Trees are vital to the life of man.
( ) 44. The conifers and broad leafed trees are quite similiar in structure.
( ) 45. A piece of wood consists of many cells growing in a vertical direction.
( ) 46. The cells in a section of wood are visible to the eye.
( ) 47. The cells in a section of wood are of one size.
( ) 48. The thickness of the cell walls are the same.
( ) 49. The cells appear as circles on wood and are commonly called annual rings.
( ) 50. The age of a tree can be determined by counting the annual rings.
( ) 51. The outside part of the trunk is called the "sapwood."
( ) 52. The center of the heartwood is called the "pith."
( ) 53. The substance in the center of the heartwood is a black hard substance.
( ) 54. After a tree gets to be a certain age the heartwood turns to sapwood.
( ) 55. Cell formation takes place in the cambium.
( ) 56. The outer part of the bark is called the "bast."
( ) 57. The cortex is used in the weaving of mats.
( ) 58. Bast furnishes materials such as cork and tannic acid.
( ) 59. The medullary rays store and distribute food material.

( ) 60. The cells in nonporous wood can be seen with the naked eye.
( ) 61. Paste wood filler is used on porous woods.
( ) 62. Wood is composed of a combination of complex cell structures.
( ) 63. Wood is lighter than water.
( ) 64. A freshly cut log placed in water will sink in a short time.
( ) 65. Trees reproduce themselves by seeds and by sprouting.
( ) 66. The seeds of a chestnut, oak, and hickory tree are heavy.
( ) 67. The seeds of oak trees fall close to the parent tree.
( ) 68. The seeds of the maple, pine, and poplar trees are heavy and rectangular shaped.
( ) 69. The first task done before starting logging operations is to build a road through the forest.
( ) 70. Three men are usually employed in cutting down a tree.
( ) 71. Modern machinery and methods are not used in logging and transporting lumber.
( ) 72. Logging is done in the spring and summer only.
( ) 73. Logs are kept in a pond while waiting to be sawed, for the purpose of preventing decay and checking.
( ) 74. A log is either *plain sawed* or *quarter sawed*.
( ) 75. Quarter-sawed boards are more expensive than plain-sawed boards.
( ) 76. The furniture made during the Queen Anne period was mostly of mahogany.
( ) 77. Cabinetmakers flourished during the reign of Queen Anne.
( ) 78. The standards of living were considerably improved during Queen Anne's reign.
( ) 79. The lowering of the backs of chairs during the reign of Queen Anne was an innovation in cabinetmaking.
( ) 80. Veneering was an unknown art during Queen Anne's reign.
( ) 81. Lacquer furniture from China was introduced during Queen Anne's reign.
( ) 82. The chairs of Queen Anne's time are difficult to recognize.
( ) 83. Chippendale usually embellished his work with carvings only.
( ) 84. Chippendale popularized mahogany as a material for furniture.
( ) 85. Chippendale never made his pieces of furniture to conform to the style and design of the Queen Anne period.
( ) 86. Chippendale's chairs were flawlessly made, well balanced as to design, and showed variety and charm.
( ) 87. Chippendale, during his later life became rich, famous, and arrogant.
( ) 88. The Adam Brothers were born in Liverpool.
( ) 89. William was the best known of the Adam brothers.
( ) 90. The Adam Brothers' style was heavy and clumsy.
( ) 91. The period of the Adam influence is referred to as the "Age of Satinwood."
( ) 92. Sheraton was a designer of furniture rather than a cabinetmaker.
( ) 93. Sheraton originated some of the most beautiful designs ever produced.
( ) 94. Sheraton's designs for satinwood and inlaid mahogany have never been surpassed.
( ) 95. Sheraton preferred mahogany to lighter woods.
( ) 96. Secret drawers in furniture were introduced by Sheraton.
( ) 97. Heppelwhite's furniture was distinctly English in character.
( ) 98. Hepplewhite infused in his designs a warmth and livableness which was lacking in the work of previous designers.
( ) 99. The early furniture of Phyfe equaled that of the English cabinetmakers in design, workmanship, and detail.
( ) 100. Duncan Phyfe was born at Waterbury, Conn.

ANSWERS TO PART I

1. F	21. T	41. T	61. T	81. T
2. F	22. T	42. F	62. T	82. F
3. T	23. T	43. T	63. F	83. T
4. F	24. F	44. T	64. T	84. T
5. T	25. F	45. T	65. T	85. F
6. F	26. F	46. F	66. T	86. T
7. F	27. F	47. F	67. T	87. T
8. T	28. T	48. F	68. F	88. F
9. T	29. T	49. T	69. T	89. F
10. T	30. T	50. T	70. F	90. F
11. F	31. F	51. T	71. F	91. T
12. T	32. T	52. T	72. F	92. T
13. T	33. F	53. F	73. T	93. T
14. T	34. T	54. F	74. T	94. T
15. F	35. F	55. T	75. T	95. F
16. T	36. F	56. F	76. F	96. T
17. T	37. T	57. F	77. T	97. T
18. T	38. T	58. F	78. T	98. T
19. T	39. F	59. T	79. T	99. F
20. F	40. T	60. F	80. F	100. T

Part II

( ) 1. Kiln dried lumber contains more moisture than air dried lumber.
( ) 2. Auger bits may be used in the drill press.
( ) 3. Auger bits are graduated in 32nds of an inch.
( ) 4. In squaring up stock by hand the board is cut to finished length first.
( ) 5. The rabbet joint is used in drawer construction.
( ) 6. Round shank bits are to be used in a hand drill.
( ) 7. Alcohol will clean a paint brush.
( ) 8. Shellac is dissolved with turpentine.
( ) 9. A framing square is larger than a try square.
( ) 10. Casein glue is more waterproof than animal glue.
( ) 11. Water stains penetrate the wood deeper than oil stains.
( ) 12. A No. 8 wood screw is larger than a No. 10 screw.
( ) 13. The jointer is used for reducing stock to uniform thickness.
( ) 14. It is not good practice to cut sharp curves on a band saw.
( ) 15. In figuring board feet lumber under 1 in. in thickness is considered as 1 in. in thickness.
( ) 16. A scraper should always be used after planing.
( ) 17. Nails are sold by the gross.
( ) 18. Walnut is a better cabinet wood than basswood.
( ) 19. Hickory is too soft to use for hammer handles.
( ) 20. A rasp is used for filing metal.
( ) 21. A cross lap joint is best used when wood is of different thicknesses.
( ) 22. The backsaw is the best to use in making a dado joint.
( ) 23. All braces are equipped with ratchets.
( ) 24. The jack plane should never be filed.
( ) 25. The blade of a plane should not have a wire edge.
( ) 26. The keyhole saw is used to cut boards to length.
( ) 27. The coping saw is used to cut thick pieces of wood.
( ) 28. The expansion bit can be used to bore several size holes.
( ) 29. Oak is a close grained wood.
( ) 30. A screw driver may be used as a chisel.
( ) 31. Gum is the base wood of most cheap furniture.
( ) 32. A nailed joint is as permanent as a screwed one.
( ) 33. The careless workman who violates the laws of a machine will have to pay for his acts in the course of time.
( ) 34. In the school shops of today, there are many machines that are designed for one armed and left handed work.
( ) 35. Many workmen consider it safe to make adjustments on machines while they are in operation.
( ) 36. Usually there are three things that cause a band saw to break; a dull saw, feeding too fast, and attempting to make too sharp a turn.
( ) 37. Boards, blocks, and end grain surfaces under 8 in. should not be run over the jointer.
( ) 38. The jointer knives are the best means to use in removing dried glue from glued up stock.
( ) 39. All belts should be dressed off with some kind of belt dressing to prevent heating up the pulley and wearing out the belt.
( ) 40. All switches should be well pushed in, and all connections well made for the best results in operating a machine.
( ) 41. Both rear and front tables of the jointer should be adjusted for deeper or shallower cuts before turning on the power.
( ) 42. Animal glue is soaked in cold water.
( ) 43. Maple is the best wood for dowels.
( ) 44. The tang chisel may safely be hammered with a mallet.
( ) 45. Nails have more holding power when driven at an angle.
( ) 46. A *2d* (2-penny) nail is larger than a *4d* nail.
( ) 47. The teeth of the turning saw should be facing the handle so as to cut on the pull stroke.

( ) 48. No. 2/0 sandpaper should be used to rub down between coats of shellac or varnish.
( ) 49. Shellac stick is used to fill up nail holes and dents in wood.
( ) 50. Always apply filler after staining.
( ) 51. Varnish should be allowed 48 hours to dry.
( ) 52. Shellac is made from a substance secreted by the lac bug.
( ) 53. Alcohol will dissolve shellac.
( ) 54. Walnut should not be stained.
( ) 55. Maple is a dull red color.
( ) 56. Pumice stone and oil are used to rub down a varnished surface to a dull smooth finish.

NOTE: *Answer fifty statements.*

ANSWERS TO PART II

1. F	15. T	29. F	43. T
2. F	16. T	30. F	44. T
3. F	17. F	31. T	45. T
4. F	18. T	32. F	46. F
5. T	19. F	33. T	47. F
6. F	20. F	34. F	48. T
7. F	21. F	35. T	49. T
8. F	22. T	36. T	50. T
9. T	23. F	37. T	51. T
10. T	24. T	38. F	52. T
11. T	25. T	39. T	53. T
12. F	26. F	40. T	54. T
13. F	27. F	41. F	55. F
14. T	28. T	42. F	56. T

Part III

Explanation: This is a brief survey concerning the following topics: cabinetmaking, carpentry, patternmaking, lumbering.

Select one of the foregoing topics and write an essay, of at least 300 words. Write on one side of paper only.

Suggested Outlines

General description of the industry
What the tradesman does
Importance of the occupation
Tools and materials used
Working conditions
Changes taking place in the industry
Preparations necessary to become a skilled worker in the trade
Age requirements
Physical and personal qualifications
School training
Apprenticeship training
Promotions in responsibility and salary

TEST ON PLASTICS

ROBERT LLOYD CANTOR
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West Virginia Institute of Technology
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Part I — True-False

Directions: Some of the following statements are true and some are false. If the statement is true, encircle the *T* at the left of the statement. If the statement is false, encircle the *F*.

T F 1. Such materials as pitch, tar, resin, amber, shellac, rubber, clay, and asphalt are natural plastics.
T F 2. Plastic objects to be colored should be closely packed together in the dye bath.
T F 3. The conditions necessary for polymerization are heat, pressure, and a catalyst.
T F 4. Plastics should be rubbed with a wet cloth.
T F 5. A catalyst is a substance added to start and hasten polymerization.
T F 6. The plastics industry came about as the result of a shortage of ivory.
T F 7. Such diversified products as skimmed milk, soybeans, formaldehyde, wood or cotton, coffee beans, coal, air, petroleum, and water are employed in the making of plastics.
T F 8. Thermoplastics are obtainable in sheet, rod, tube, and powder form, and may be heated sufficiently to become pliable.
T F 9. Typical thermoplastics are Catalin and Bakelite.
T F 10. Plastics can be sawed with a saw just like wood; many can be bent when heated; they can be twisted, drilled, frosted, engraved, cemented, fused, and colored.
T F 11. Always try to hide all joints in assembling plastic objects.
T F 12. All holes should be drilled before polishing.
T F 13. Never use false construction to build up thick parts from thin plastics.
T F 14. If plastic has masking paper on it then it should be left on while it is grooved.
T F 15. A good cutting speed for drilling plastics is 120 ft. per minute.
T F 16. Faces of plastic sheets should always be planed.
T F 17. Sanding of plastics can be done either wet or dry.
T F 18. All traces of pumice and other abrasive compounds are removed by rinsing the plastic in water.
T F 19. Light can be piped around corners and curves of acrylics.
T F 20. Thermoset plastics are used extensively in aircraft instrument panel fittings and knobs.
T F 21. A "pock-marked" rough Lucite project may be buffed directly without sanding for a pleasing effect.
T F 22. Most of the tools used in working with plastics may be made or improvised in the home or school workshop.
T F 23. Four methods of applying cement are dip, wipe, brush, and pour.
T F 24. Ashing is a buffing operation in which wet abrasive is applied to a loose muslin buff to remove tool marks and irregularities on the surface of plastics.
T F 25. The drill press may be used for polishing by putting a buffing wheel on a bolt and mounting it in the drill press chuck.
T F 26. Small inexpensive screw drivers can be made into engraving tools of various shapes and sizes.
T F 27. Whenever possible, plastics should be cemented rather than heated and shaped.
T F 28. A very satisfactory disk sander can be made by merely fastening an abrasive sheet to a wood or metal disk and use this tool on a buffing wheel arbor or with a bolt in a drill press chuck.
T F 29. In the beginning designers worked hard to camouflage plastics.
T F 30. The protective masking paper on both sides of the plastic should be removed before work is begun on the project.
T F 31. A coping saw should be used when very thin plastic is being cut.
T F 32. A cabinet scraper blade may be used to remove plane and saw marks from the edges.
T F 33. Methylene dichloride and monomeric methyl methacrylate (50–50) is known as cement 1–A.
T F 34. Chloroform is a solvent for Lucite-Plexiglas and may be used as a cement.
T F 35. With most plastic dyes the three basic colors — red, blue, and yellow — can be mixed to give all the other colors.
T F 36. Cleansing powder is a good cleaning agent to use on plastic.
T F 37. *Vanishing cream* is a good cleaner for Lucite.
T F 38. Sandpaper and masking tape can be combined and used to make designs on plastics.
T F 39. Engraving should always be done after the project is heated and formed.
T F 40. Stamping designs cannot be effective on plastics although they can be used effectively on leather and metal projects.
T F 41. A woodworking marking gauge can be useful for plastic surface decoration.
T F 42. Leathercraft pricking wheels can be used to get an interesting effect on plastic.
T F 43. Any cleansing solution used on glass can be used to clean plastics.
T F 44. To buff a plastic project the buffing lathe should be run at a high speed to get best results.
T F 45. Decalcomania is not a satisfactory method for plastic decoration.
T F 46. The silk screen process can be used for decorating plastics.
T F 47. Engraving below the depth of the dyed surface will produce good results.
T F 48. The use of self-tapping screws will avoid the breaking of tops.
T F 49. Veining is one of the most difficult forms of surface decoration.
T F 50. Furniture wax on plastics resists fine scratches.

Part II — Multiple-Choice

Directions: Encircle the proper response.

51. In welding plastics the welded joint is (*a*) almost as strong as the plastic, (*b*) exactly the same strength, (*c*) stronger than the plastic itself.
52. Which of the following men is responsible for the formula for acrylic plastics, now known as Plexiglas? (*a*) Hyatt, (*b*) Rohm, (*c*) Baekeland.
53. Raw materials such as coal, air, and water are put through complex chemical changes and emerge as a synthetic resin called (*a*) plastic, (*b*) Bakelite, (*c*) nylon.
54. After (*a*) 1920, (*b*) 1930, (*c*) 1940 the plastic industry developed particularly fast.
55. Which of the following are used in the manufacture of plastics? (*a*) skimmed milk and soybeans, (*b*) coffee beans, coal, and air, (*c*) only part of the foregoing items in *a* and *b*, (*d*) all of them.
56. In acrylic work it is possible to modify designs as the project is being built because (*a*) plastic is inexpensive and, therefore, nothing is lost if the design is altered, (*b*) they can be reshaped repeatedly, (*c*) of man's innate ingenuity.
57. Plastics which cannot be reshaped when heated are called (*a*) thermosetting, (*b*) thermoplastic, (*c*) thermostatic.
58. (*a*) Asbestos, (*b*) mica, (*c*) formaldehyde is added to plastics which require great resistance to heat.
59. The method of welding acrylic plastics similar to the procedure used by the Indians to produce fire is called (*a*) friction welding, (*b*) thermowelding,, (*c*) thermit welding.
60. Lucite at the temperature of (*a*) 500, (*b*) 660, (*c*) 780 degrees becomes depolymerized.
61. Heating a cemented joint will (*a*) cause little effect, (*b*) melt the cement, (*c*) cause warping.
62. A plastic project is (*a*) dyed before completion, (*b*) dyed after completion, (*c*) makes no difference.
63. Light tints are possible on many plastics by using a concentrated solution of dyes such as (*a*) poster paint, (*b*) all-purpose Rit, (*c*) colored India inks.
64. The cement providing the strongest acrylic joint is probably (*a*) cement 1–A, (*b*) cement 1–C, (*c*) chloroform, (*d*) acetone.
65. The simplest form of surface decoration is (*a*) internal carving, (*b*) inlaying, (*c*) veining.
66. When threading plastics the best results will be obtained if (*a*) fine threads, (*b*) coarse threads, (*c*) medium threads are used.
67. What kind of drill bit should be used to drill holes in plastics? (*a*) auger, (*b*) twist, (*c*) power drill.
68. Plastics are squared in the same manner as (*a*) copper, (*b*) wood, (*c*) paper.
69. Cellulose acetate is thermoplastic and can be formed when it is heated to a temperature of (*a*) 350 to 380 deg. F., (*b*) 250 to 280 deg. F., (*c*) 450 to 480 deg. F.
70. Acrylic plastics should not be below a temperature of (*a*) 100 deg. F., (*b*) 80 deg. F., (*c*) 110 deg. F., for cold forming.
71. Files are usually designed to cut in (*a*) one, (*b*) two, (*c*) three directions.
72. (*a*) Hydrochloric acid, (*b*) Acetone, (*c*) glacial ascetic acid is used as an accelerator for many opaque cements.
73. Cemented parts will tend to (*a*) warp, (*b*) creep, (*c*) craze if clamps are not used.
74. Where several thin sheets are stacked together to be sawed, pieces of (*a*) waxed, (*b*) tissue, (*c*) gummed wrapping paper inserted between each two sheets will help.
75. Dip dyes can be used over and over again almost indefinitely but may require (*a*) boiling, (*b*) straining, (*c*) stirring before each using.

Part III — Completion

Directions: Fill in the proper response.

76. Plastics which require great electrical insulation power require the addition of .....
77. Cementing a thin material to the face of another piece of plastic for decorative purposes is called .....
78. The catalyst is a substance added to plastic to start and hasten .....
79. Red is a warm color, while .... is known as a cool color.
80. As a safety measure when bending and forming plastics, be sure to wear .....
81. The first piece of equipment necessary for shaping by the vacuum process is an .....
82. Plastic is swung in the air after it is taken out of an oven to .... it.
83. Putting dyes on plastics with a brush is likely to cause .....
84. For inlaying plastics, colored paste and stick .... are available.
85. Plastic cement will not hold well on .... surfaces.

Part IV — Matching

Directions: The meaning or association of the words in the following column are to be found in the statements in the next group, lettered *a*, *b*, *c*, etc. In the space to the left of each number, write the letter from the statement in that column, which explains the meaning or association of that particular word.

86. Crazing
87. Acrylic plastic
88. Cementing method
89. Mild soap solution
90. Sharp curves, angles
91. Dr. Leo Baekeland
92. Rubber gloves
93. Buffing wheel
94. Jeweler's saw
95. Plastic coloration
96. Water
97. Dr. J. W. Hyatt
98. Infra-red bulb
99. Wood, plaster negative mold
100. Hand polishing

a) may be used as a threading lubricant
b) should be avoided
c) Bakelite
d) split or tiny fissures
e) dip dye
f) soak
g) "memory or homing" instinct
h) piercing
i) mottled
j) sandpapering
k) vacuum forming
l) splash pan
m) billiard ball substitute
n) mild liquid abrasive
o) bending plastic
p) hide glue
q) coarse abrasive

Part I

1. T	11. F	21. T	31. F	41. T
2. F	12. F	22. T	32. T	42. T
3. T	13. F	23. T	33. T	43. F
4. F	14. T	24. T	34. T	44. F
5. T	15. T	25. T	35. T	45. F
6. T	16. F	26. T	36. F	46. T
7. T	17. T	27. F	37. T	47. T
8. T	18. T	28. T	38. T	48. T
9. F	19. T	29. T	39. F	49. F
10. T	20. T	30. F	40. F	50. T

Part II

51. a	56. b	61. a	66. b	71. a
52. b	57. a	62. c	67. b	72. a
53. a	58. a	63. b	68. b	73. b
54. c	59. a	64. a	69. b	74. a
55. d	60. b	65. c	70. b	75. b

Part III

76. Mica	81. Aspirator
77. Overlaying	82. Caseharden
78. Polymerization	83. Brush streaks
79. Blue (or green or violet)	84. Filler
80. Gloves	85. Polished

Part IV

86. d	89. a	92. e	95. i	98. o
87. g	90. b	93. l	96. j	99. k
88. f	91. c	94. h	97. m	100. n

ELECTRICAL ACHIEVEMENT TEST

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This achievement test consists of 161 points and covers material that a student should know to have a basic knowledge of electricity. The information in this test very closely follows the outline as given in "Standards of Attainment in Industrial Arts Teaching," American Vocational Association.

The following topics are included as things a pupil should know.

1. Properties of magnets and the magnetic field
2. Sources of electric current and characteristics
3. How electric current is conveyed
4. Kinds of conductors and wire sizes
5. The meaning of volt, ampere, and watt
6. Conversion of electric power to heat, light, and power

7. Difference between direct and alternating current
8. Sources of alternating current
9. Meaning of phase and cycle
10. Meaning of series, parallel, and series-parallel circuits
11. Resistance
12. Ohm's law
13. Operation of electromagnetic devices
14. Electrical soldering
15. Effect of overloads
16. Wiring diagrams and symbols
17. Meters and their uses
18. Construction and workings of wet and dry cells
19. Fuses and their uses
20. Electric lamps, use, and how made
21. Motor types and how to identify them
22. Transformers and their operation
23. Types, purposes, and theory of condensers
24. Principles of three wire systems
25. Pay-roll jobs and opportunities in the electric industry
26. Modern electric fixtures

Part I. Mutiple choice	Points	30
Part II. Matching	Points	47
Part III. Completion	Points	31
Part IV. Identification	Points	34
a) Tools		
b) Symbols		
c) Abbreviations		
Part V. Controlled Completion	Points	7
Part VI. Problem	Points	12
Total	Total Points	161

This test is designed to test your achievement in the elements of basic electricity. Carefully follow the directions given before each part of the test. Do not spend your time over any one question or any particular part of the test. Go over the entire test and when you have answered all that you can without puzzling over them, go back and spend the remaining time on those you missed.

Part I. Multiple Choice

Directions: Choose the one best answer from the items following each statement and put the letter in front of that item in the blank spaces.

The first one is answered as an example.

b. X. A magnet will attract (A) copper, (B) iron, (C) porcelain, (D) glass.

.... 1. The instrument used for measuring electrical current is the (A) voltmeter, (B) wattmeter, (C) Ammeter, (D) Ohmmeter.

.... 2. A number 14 wire will safely carry (A) 5 amperes, (B) 10 amperes, (C) 15 amperes, (D) 20 amperes.

.... 3. In alternating current, when we talk about phase we mean (A) value of capacitance in circuit, (B) value of voltage in the circuit, (C) time relationship of voltage or current in circuit, (D) relationship of current to voltage and resistance.

.... 4. Weak spots in an electrical circuit for protection purposes are called (A) overload relays, (B) protectors, (C) safety switches, (D) fuse links.

.... 5. The unit of electric power is the (A) farad, (B) henry, (C) watt, (D) power factor.

.... 6. All meter movements are originally (A) voltmeters, (B) ohmmeters, (C) current meters, (D) thermo ammeters.

.... 7. When dry cells are connected in parallel the total voltage is (A) greater than any of the single cells, (B) the same as the voltage of a single cell, (C) equal to the number of cells times 1.5 volts, (D) equal to the number of cells 2.2 volts.

.... 8. The flux used for radio and electrical soldering is (A) sal ammoniac, (B) soldering salts, (C) rosin, (D) acid core solder.

.... 9. A 40-watt fluorescent tube requires which of the following voltage to cause it to light (A) 110 volts, (B) 130 volts, (C) 208 volts, (D) 90 volts.

.... 10. The series type motor is known for its (A) constant speed, (B) good starting torque, (C) poor starting torque, (D) low starting torque.

.... 11. Power can be calculated by (A) multiplying voltage by resistance, (B) dividing voltage by resistance, (C) multiplying voltage by resistance squared, (D) dividing voltage squared by resistance.

.... 12. A magnet made with turns of wire wound on a soft iron core with current to energize it is called (A) natural magnet, (B) permanent magnet, (C) electromagnet, (D) alloy magnet.

.... 13. A poor conductor of electricity is (A) silver, (B) copper, (C) pure water, (D) carbon.

.... 14. The compass is an instrument from which of the types listed below (A) electrical, (B) mechanical, (C) magnetic, (D) dielectric.

.... 15. The shunt wound motor is known for its (A) high starting torque, (B) good speed regulation, (C) low cost, (D) operation without brushes.

.... 16. The three wire power distribution system which gives 220 volts regardless of which two wires are used is the (A) star, (B) "Y," (C) delta, (D) quarter-phase.

.... 17. The type of fuse that has to be screwed into its socket or sockets is the (A) buss fuse, (B) link fuse, (C) plug fuse, (D) cartridge fuse.

.... 18. The worker in the electrical field whose work requires a good background in mathematics, physics, and materials is an (A) electrical technician, (B) house electrician, (C) electrical engineer, (D) electrical contractor.

.... 19. If additional lamps are connected to a circuit in parallel, the total resistance will (A) increase, (B) decrease, (C) be the same, (D) decrease in proportion to the number of lamps added.

.... 20. Half and half solder as used in radio and electric work melts at (A) 100° F., (B) 370° F, (C) 480° F., (D) 550° F.

.... 21. The variations in voltage produced in a single a.c. generator throughout one cycle may be represented by (A) sine curve, (B) a saw tooth curve, (C) a series of vertical lines, (D) no possible combination of curves.

.... 22. Resistors in series with a meter to increase its voltage range are called (A) multipliers, (B) shunts, (C) series by-passes, (D) milliamperes.

.... 23. The number of turns of wire on the secondary of a transformer is doubled, the voltage on the secondary (A) is decreased to one half as much, (B) stays the same, (C) is 4 times as great, (D) is twice as great.

.... 24. The underwriters' knot is used mostly (A) in using solid wire, (B) in motor wiring, (C) in knot and tube wiring, (D) in plug and fixture wiring.

.... 25. The best soldering flux for radio and electrical work is (A) soldering salts, (B) acid, (C) soldering paste, (D) rosin.

.... 26. The most commonly used flashlight battery is the (A) size A, (B) size B, (C) size C, (D) size D.

.... 27. To get a check on the condition of your automobile battery, we use a

(or an) (A) ohmmeter, (B) hydrometer, (C) ammeter, (D) voltmeter.

.... 28. The telephone was invented by (A) Marconi, (B) Simon Ohm, (C) Edison, (D) Bell.

.... 29. For heating elements we usually use (A) copper wire, (B) michrome wire, (C) silver wire, (D) carbon.

.... 30. A rotating vector may be used (A) to check the speed of a generator, (B) to represent the current or voltage variations of an a.c. generator, (C) to generate voltage, (D) to generate current.

Part II. Matching

Directions: From the lettered column select the item most closely associated with items in the numbered column. Place this letter in the correct blank. Number 31 is answered as an example.

(*B*) 31. e.m.f.
.... 32. kind of current
.... 33. a.c. resistance
.... 34. mechanical switch
.... 35. source of voltage
.... 36. kind of conductor
.... 37. insulating material
.... 38. high starting torque

A. series
B. voltage
C. vibrator
D. battery
E. silver
F. a.c.
G. impedance
H. pure water
I. parallel
J. series-parallel

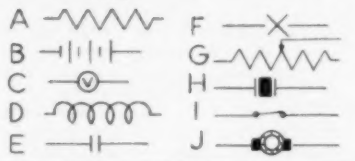
.... 39. Ohm's law
.... 40. power formula
.... 41. voltage
.... 42. a.c. power
.... 43. impedance
.... 44. resistance
.... 45. current
.... 46. wire resistance

A. $R = \frac{K \times L}{CM}$
B. $\sqrt{R^2 + X^2}$
C. $E = I \times R$
D. $E^2 R$
E. $E \times I \times \text{Cos.}\theta$
F. $P = E \times I$
G. $\frac{1}{2\pi\sqrt{LC}}$
H. $I \times R$
I. $\frac{E}{I}$
J. $\frac{E}{R}$

.... 47. voltage
.... 48. current
.... 49. power
.... 50. vector
.... 51. micro
.... 52. a.c.
.... 53. resistance
.... 54. impedance

A. kw
B. ~
C. E.m.f.
D. βh
E. I
F. Zz
G. 100, 40J
H. Ω or ω
I. μ
J. θ

.... 55. condenser
.... 56. resistor
.... 57. choke
.... 58. Potentiometer
.... 59. voltmeter
.... 60. battery
.... 61. generator
.... 62. spark gap



.... 63. electrolyte
.... 64. armature
.... 65. transformer
.... 66. coil
.... 67. series motor
.... 68. condenser
.... 69. breaker points
.... 70. knob and tubes

A. changes to a different voltage
B. dielectric
C. insulator
D. ignition system
E. antenna
F. current lags voltage
G. vacuum cleaner
H. door bell
I. ground connection
J. specific gravity

.... 71. series
.... 72. shunt
.... 73. series-parallel
.... 74. S.P. switch
.... 75. fuse
.... 76. binding post
.... 77. B.X. cable
.... 78. storage battery

A. increased current possible
B. metallic covered wires
C. advantage of greater current and voltage
D. buss type
E. overload relay
F. greater voltage possible
G. can handle only one circuit
H. Edison
I. wire fastener
J. asbestos covered wires

Part III. Completion

Directions: In the following statements fill in the blanks with the best and most accurate word to make the statement *true*. The first one is answered as an example.

Ohm X. The unit of resistance is known as the .....
.... 79. The connection of dry cells so as to make possible increased current drain is the ..... connection.
.... 80. Opposition to flow of lines of magnetic flux is called .....
.... 81. The dynamo or generator is a conversion from mechanical to ..... energy.
.... 82. The combination of an iron core and a coil is known as an .....
.... 83. The unit of capacitance is the .....
.... 84. The smallest unit which still retains all of the original characteristics of an element is the .....
.... 85. The henry is the unit of .....
.... 86. Frequencies which are multiples of the fundamental are called .....
.... 87. The current through an inductance ..... the voltage across the inductance by 90°.
.... 88. Ammeters are always connected in ..... with the current which is to be measured.
.... 89. A dielectric substance is an .....
.... 90. A multimeter having a resistance of 1000 ohms per volt uses a ..... mill movement (as the fundamental meter movement).
.... 91. The range of an ammeter can be increased by the use of .....
.... 92. All meters used in voltmeters, ammeters, ohmmeters, and multimeters are originally ..... meters.
.... 93. Voltmeters are always connected in ..... with the circuit whose voltage we wish to measure.
.... 94. The force or potential that causes current to flow in a complete circuit is the .....
.... 95. The voltage of a fully charged lead-acid cell is .....
.... 96. The unit of current flow in a circuit is the .....
.... 97. The best and most economical conductor of electricity is .....
.... 98. The voltage of a flashlight cell is .....
.... 99. The frequency of alternating current most used in the United States is ..... cycles.
.... 100. In a transformer the power is transformed from primary to the secondary circuit by the process of .....
.... 101. The natural magnetic material is named .....
.... 102. The part of the automobile ignition system which makes and breaks a 6-volt circuit is the .....
.... 103. In dealing with a.c. power, in addition to voltage and current we have to consider .....
.... 104. Increasing the distance between the plates of a condenser causes its capacity to be .....
.... 105. In Christmas tree lights, when all eight lights have to be lighted at once we call this circuit a ..... circuit.
.... 106. The unit used to measure conductivity of a circuit is the .....
.... 107. An automobile starter motor is an example of a ..... type motor.
.... 108. When dry cells are connected in series the total voltage is .....
.... 109. At frequencies below resonance the

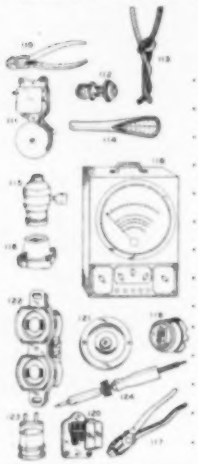
series circuit acts like a ..... plus a resistor.

Part IV. Identification

Materials and Tools

Directions: Below are pictured some materials and tools. Write the name of each tool or piece of equipment in the blank whose number corresponds to the correct tool or equipment.

Number 110 is answered as an example.



Diagonal Cutters 110
..... 111
..... 112
..... 113
..... 114
..... 115
..... 116
..... 117
..... 118
..... 119
..... 120
..... 121
..... 122
..... 123
..... 124

Symbols

Directions: Identify the following symbols by writing the correct word in the blank. The first one is answered as an example.

X VOLTAGE E
125 Ω or W
126 μ
127 ⊖
128 θ
129 Ø
130 ~
131 ⏚
132 ⏚
133 Ⓜ
134 λ

Abbreviations

Directions: Identify the following abbreviations by writing the correct word in the blank. The first one is answered as an example.

X ALTERNATING CURRENT A.C
135 K.C.
136 Gnd.
137 f
138 Ant.
139 A.
140 D.C.
141 Kwh
142 Mf
143 h
144 Ip

Part V. Controlled Completion

Directions: In each blank insert the letter of the item listed below which, when inserted, best completes the meaning of the paragraph. Number 145 is answered as an example.

H 145. In a doorbell ..... energy is converted into mechanical
.... 146. motion. This is done by allowing ..... to flow through the
.... 147. coils which causes them to become ..... and pull the armature
.... 148. down to the pole pieces. When the ..... moves, the clapper
.... 149. moves with it and strikes the bell, also the ..... now
.... 150. become open, current no longer flows, ... disappears
.... 151. and ..... tension causes armature to return to original position.
.... 152. This causes contact points to ..... and the cycle starts over.

A. open
B. magnetized
C. current
D. close
E. voltage
F. contact points
G. spring
H. electrical
I. doorbell
J. ground
K. armature
L. magnetic field

Part VI. Problem

Directions: Read the problem below and then answer the questions concerning it by writing YES or NO in the blank spaces.

A customer brings a doorbell into your shop for repair, and his complaint is that it rings only once instead of continuously when the door button is pushed and held down.

.... 153. Would you expect to find the coil open?
.... 154. Bad contact points on the armature or frame could be the trouble?
.... 155. The contact points could be out of adjustment?
.... 156. The voltage in the circuit could be missing through faulty transformer or dry cells?
.... 157. The hammer could be set too closely to the gong?

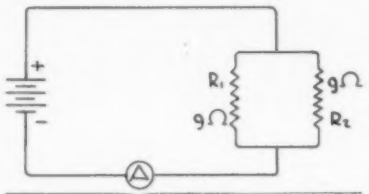
Directions: Read the statement of the problem below and then insert the correct answer in the blank in front of each question.

A toaster marked 1000 watts, 120 volts, is brought into the shop in which you are working; the customer's complaint is that it insists on blowing fuses.

.... 158. How much current should a toaster draw when working properly?
.... 159. How much resistance would you expect to find in the element if not defective?
.... 160. The cord and plug can be separated from the toaster itself, how much resistance would you expect to find between the two wires in the cord?

Directions: From the circuit shown determine the answer and write it in the blank in front of each statement.

.... 161. How much current will be read on the ammeter if dry cells are used?
.... 162. If dry cells are used, how much voltage is available?
.... 163. If R_2 were removed, what would the ammeter read if dry cells are used?
.... 164. What is the total resistance in the circuit?
.... 165. What e.m.f. is available if wet cells are used?



ELECTRICAL ACHIEVEMENT TEST — SCORING KEY

1. C	14. C	27. B	40. F	53. H	66. F
2. D	15. B	28. D	41. H	54. F	67. G
3. C	16. C	29. B	42. E	55. E	68. B
4. D	17. C	30. B	43. B	56. A	69. D
5. C	18. C	31. B	44. I	57. D	70. C
6. C	19. B	32. F	45. J	58. G	71. F
7. B	20. B	33. G	46. A	59. C	72. A
8. C	21. A	34. C	47. C	60. B	73. C
9. C	22. A	35. D	48. E	61. J	74. G
10. B	23. D	36. E	49. A	62. F	75. D
11. D	24. D	37. H	50. G	63. J	76. I
12. C	25. D	38. A	51. I	64. H	77. B
13. C	26. D	39. C	52. B	65. A	78. H

79. parallel
80. reluctance
81. electrical
82. electromagnet
83. farad
84. atom
85. inductance
86. harmonics
87. lags
88. series
89. insulator
90. one
91. shunts
92. current
93. parallel
94. voltage
95. 2.2
96. ampere
97. copper
98. 1.5
99. 60
100. induction
101. loadstone
102. points
103. phase
104. decreased
105. series
106. Mho
107. series
108. increased
109. condenser
110. diagonal cutters
111. doorbell
112. plug
113. underwriters' knot
114. loom
115. socket
116. test meter
117. electrician side cutters
118. surface socket
119. toggle switch
120. buzzer
121. push button
122. receptacle
123. weatherproof socket
124. soldering iron
125. ohms
126. micro
127. electron
128. angle
129. flux
130. cycles
131. delta
132. vector
133. meter
134. wave length
135. kilocycles
136. ground
137. frequency
138. antenna
139. ampere
140. direct current
141. kilowatt hour
142. micro-farad
143. henry
144. plate current

145. H	148. K	151. G	154. Yes	157. Yes
146. C	149. F	152. D	155. Yes	158. 7.5a
147. B	150. L	153. No	156. No	159. 16 Ω

160. infinite high
161. 1 ampere
162. 4.5
163. ½ ampere
164. 4½ ohms
165. 6.6 volts

TESTS IN THE GENERAL SHOP

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Since the general shop is or should be the first steppingstone in a student's vocationally or technically planned course, it is very important that he gets as much information about tools and materials as soon as possible.

In order to accomplish this the writer has found it advisable to use objective tests, such as *true-false, completion, multiple-choice,* and *matching*. After the tests have been given, the students exchange papers. The instructor then reads the questions (or has each student read one), gives the correct answer, and also explains just what each term means, so that the class will see and understand clearly just how this related information applies to their shopwork.

Example: In the accompanying test the word or term *kerf* is associated with *saw teeth*, because the kerf is the slit produced by these teeth in making a saw cut.

These tests are given early in the course to the 7B classes and the first time, no grade is entered in the class book. About the middle of the semester the same tests are given to these classes, graded and their grades entered in class record book. The following percentages have been found to work out satisfactorily (A—95–100) (B—80–90) (C—60–75) (D—45–55) (F—under 45 per cent).

The attention that the students give while these test questions are explained is very gratifying.

Matching Test

Directions: In the space at the left of the words in the first column, write the number of the word, found in the right column, which is most closely associated with it.

(5) kerf	1. brace
(3) tang	2. nail set
(4) coping saw	3. file
(1) auger bit	4. irregular curves
(2) brads	5. saw teeth
(5) plane	1. gouge
(4) groove	2. auger bit
(3) countersink	3. flathead screw
(1) chisel	4. router plane
(2) lead screw	5. working face
(4) try square	1. finger gauging
(5) expansion	2. knife
(2) draw	3. drill
(3) hand	4. working edge
(1) chamfer	5. bit
(4) chisel	1. hammer
(5) solder	2. punch
(2) center	3. plate
(1) ball peen	4. cold
(3) tin	5. lead and tin
(3) laying off spaces	1. horizontal lines
(5) isometric	2. circle
(4) three-view drawing	3. dividers
(1) T square	4. orthographic projection
(2) compass	5. pictorial drawing

Your name .....

Grade earned—A...B...C...D...F...

Grading scale: A—95–100; B—80–90; C—60–75; D—45–55; F—less than 45 per cent.

ACHIEVEMENT TEST IN MECHANICAL DRAWING GRADE X — A MIDYEAR TEST

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Description and Purpose

The test is in six parts and is entirely objective. Part I is a true and false test of 58 items. These items are grouped under four major headings which are: (1) Instruments and Materials, (2) Geometric Problems, (3) Orthographic Projection, and (4) Dimensioning. Part II is a matching test of 15 items on the subject of geometry for mechanical drawing. Part III is a test of 5 items in geometric construction by use of compasses and straightedge. This is a test for skill as well as understanding. To be objective, each item must be completely correct. No credit is given for items partly right. Part IV of 4 items is a multiple-choice test on computing the margins for centering a three-view orthographic drawing. Part V is a completion test of 6 items in orthographic projection. Like Part III, it is a test in skill as well as understanding for the student must use the drawing board, T square, and triangle to supply the missing views. Part VI, A, B, and C are blueprint reading tests of 35 items which vary in degree of difficulty.

The test has been designed to measure pupils' knowledge and understanding of mechanical drawing, but at the same time to measure the pupils' skill in handling instruments, and their ability to read drawings. It is an achievement test.

The purpose of the test:

1. Find out how much the pupils know in order that the instructor may know what to teach next. After giving this midyear test an instructor may discover that some or all pupils are not ready to go on with the more advanced work. The test would show just what phases of the first half year's work needed review.

2. Determine what pupils need remedial work. Since the test items are grouped under distinct units of mechanical drawing it would be an easy matter to discover in just what phases of drawing a student is weak. By the use of the student record sheet for the tabulation of numerical scores weaknesses can be easily spotted. The student record sheets for all classes in Grade X would be the sources from which a special class could be made up. Individuals showing decided weaknesses in a majority of the units could be selected for this class which would receive special instruction.

3. Check the instructor. If a large number of pupils failed the test it might be an indication that the instructor fell down on the job. Even the best of instructors may at times slide over objectives rather hurriedly in order to meet the requirements of the course.

4. Determine pupils' marks. Since the test samples widely the field of elementary mechanical drawing, it can truly be said to be comprehensive. From the curricular standpoint the test is valid. I have checked all items in the very best of mechanical drawing textbooks. A valid and comprehensive test should be a very good measure for pupils' marks. Since the test is entirely objective, a more reliable basis for assignment of pupils' marks will be furnished than that afforded by the subjective tests of teachers.

5. Compare the results obtained by the teacher of one class with the accomplishments of similar classes in the same school or in other schools.

6. Motivate pupil effort. Pupils will try harder and put more into their work when they know that they are going to be thoroughly and scientifically tested.

The writer is grateful to Louis A. Van Ham, head of the drafting department at Boston Technical High School. Mr. Van Ham offered the drawings for Part VI of the test. The writer has revised them to their present form.

The test has been administered to 450 high school students of grade X. The students have had one-half year's work in mechanical drawing consisting of three 40-minute periods a week. From their scores, norms have been determined. The median is 129.4. The mean calculated is 127.4. The standard deviation is 24.45. From these norms, the students' raw scores are converted into class marks. The following table is significant:

A = Above 164
B = 140 to 164
C = 116 to 139
D = 90 to 115
E = Below 90

Directions for Administering

The time element as a very important item of validity. If strict time limits are not adhered to, the test will be invalid. Established limits for each part follow.

Part I	allow	20 min.	+	2
Part II	allow	8 min.	+	2
Part III	allow	20 min.	+	2
Part IV	A allow	2½ min.	+	2
	B allow	2½ min.		
Part V	allow	15 min.	+	2
Part VI	A allow	5 min.	+	2
	B allow	5 min.		
	C allow	10 min.		
	Total	88	+	12 = 100 min.

The total students' working time is 88 minutes. Allow 12 minutes for giving out papers and the reading of directions. The directions for the students are printed on each part of the test. Time limits were arrived at by trying out the test with students of average ability. Students should be told to keep their papers face down until all tests are given out.

Directions for Scoring

Ease in scoring as an important element in objective tests. Space is provided at the bottom of each test part for marking the score. These scores may be totaled on page 1 of this test. Since the test is wholly objective, anybody may score it. A key to all test parts is provided. With the student class record sheet, each pupil's results may be analyzed and remedial measures taken. A summary of the maximum scores follows:

Part I		Number right	= 58
Part II		Number right	= 15
Part III		Number right = 5×3 =	15
Part IV	(A)	Number right = 2×2 =	4
	(B)	Number right = 2×2 =	4
Part V		Number right = 6×3 =	18
	(A)	Number right = 10×2 =	20
Part VI	(B)	Number right = 10×2 =	20
	(C)	Number right = 15×2 =	30
		Total score =	184
		Total number of items =	50

ACHIEVEMENT TEST IN MECHANICAL DRAWING

Grade X — A Midyear Test

by

Andrew G. Lofgren

Identification Record

Name .....
Last First Middle
Age ..... Date of Birth .....
High School .....
City ..... State .....
Length of Drawing Period in Minutes .....
Number of Drawing Periods per Week .....

Individual Pupil Score Sheet

Part I		No. right	=
Part II		No. right	=
Part III		No. right =	$\times 3$ =
Part IV	(A)	No. right =	$\times 2$ =
	(B)	No. right =	$\times 2$ =
Part V		No. right =	$\times 3$ =
	(A)	No. right =	$\times 2$ =
Part VI	(B)	No. right =	$\times 2$ =
	(C)	No. right =	$\times 2$ =
		Total score =	

Part I — True and False

Directions: Read the following sentences carefully. If a statement is true, draw a freehand circle about the *T*. If a statement is false, circle the *F*. For example, the first statement is true, so the *T* has been circled.

Instruments and Materials

(T) F 1. One of the triangles used in mechanical drawing has two 45-deg. angles and one 90-deg. angle.

T F 2. The T square and the 30–60 degree triangle together are used for drawing vertical lines.

T F 3. The book compasses are used for drawing circles of 7/8-in. radius or less.

T F 4. The 4-H pencil should be used for lining-in a drawing.

T F 5. The normal position of the T square should be with the head against the top edge of the drawing board.

T F 6. The H pencil is preferable for drawing extension and dimension lines.

T F 7. By means of the architect's scale the drawing of an object may be made full size, three-quarter size, half size, or one-eighth size.

T F 8. The scale 1½ in. = 1 in. means that 1½ in. on the drawing equals 1 in. on the object, or the drawing is 1½ times the size of the object.

T F 9. The dividers are used to transfer distances.

T F 10. If a circle is to be made larger than 3 in. in radius, the legs of the compass should be bent so that they are perpendicular to the paper.

T F 11. The bevel on a compass lead should be on the inside.

T F 12. Drafting tape is more economical than thumbtacks for holding the paper to the drawing board.

T F 13. In laying out the border lines of a drawing paper, the measuring should be done on one vertical and one horizontal line.

T F 14. In making a three-view orthographic drawing the views should first be "blocked-out."

T F 15. A center line is a heavy line of alternate long and short dashes.

Geometric Problems

T F 16. The radius of a circle is one half its diameter.

T F 17. A line that is tangent to a circle has two points in common with the circle.

T F 18. A tangent to a circle makes a right angle with the radius drawn to that point.

T F 19. The diameter of a circle is the shortest chord that may be drawn in the circle.

T F 20. A perpendicular to a line forms an angle of 90 deg. with the line.

T F 21. An obtuse angle is an angle greater than 180 deg.

T F 22. An acute angle is greater than 90 but less than 180 deg.

T F 23. The perimeter of a polygon is the length of its outline or of the lines which enclose it.

T F 24. An equilateral polygon is a polygon that has all its angles equal.

T F 25. A quadrilateral is a four-sided polygon.

T F 26. The diagonal of a quadrilateral is a straight line joining two opposite vertices.

T F 27. The angles of any triangle add up to 150 deg.

T F 28. To bisect means to divide into two equal parts.

T F 29. To construct a square, a perpendicular to a line must first be drawn.

T F 30. To find the center from which an arc is drawn, bisecters of chords are employed.

T F 31. Any angle inscribed in a semicircle is a 60-deg. angle.

T F 32. A regular hexagon has a long and short diameter.

Orthographic Projection

T F 33. The vertical height of the top view of an object, as shown on drawing paper, is equal to the horizontal width of the side view.

T F 34. In orthographic projection the height of the front view of an object is equal to the height of the top view.

T F 35. If perpendiculars are extended from all points on the face of an object to a plane of projection, the picture so formed on the plane of projection is known as an orthographic projection.

T F 36. A perspective drawing shows an object as viewed from one point, the eye of the observer.

T F 37. In orthographic projection, the length of the top view, in the drawing of an object equals the length of the side view.

T F 38. In the orthographic projection of an oblique surface the projection lines are at right angles to the oblique surface.

T F 39. Cylindrical objects may be fully represented in two views.

T F 40. The principal view is that view which gives the most information concerning the characteristic form of the object.

T F 41. The principal view is generally the front view of a three-view drawing.

Dimensioning

T F 42. Dimension lines are fine solid lines ending with arrowheads and stopping 1/16 in. from extension lines.

T F 43. The total height of a fractional dimension should equal the height of a single numeral.

T F 44. The length of an arrowhead is approximately three times its thickness.

T F 45. A leader to a circular hole should be drawn at an angle of 60 deg. or 45 deg. with the horizontal.

T F 46. Dimensioning is usually done in

a horizontal or vertical position, with the figures reading from the bottom or the right-hand side of the drawing.

T F 47. A circular hole should be located by dimensioning to its edge.

T F 48. In the dimensioning of a cylindrical object, both the diameter and length should be placed about the rectangular view.

T F 49. A working drawing must be fully dimensioned.

T F 50. The radius should be given as the dimension for the size of a round hole.

T F 51. Extension lines should touch the outline of a view.

T F 52. A dimension line should be no nearer to a view than ⅛ in.

T F 53. According to the American Standards Association, the figure denoting the size of an angle may be placed in a horizontal position, for angles of 90 deg. or less.

T F 54. The word *drill* following the dimensioning of a circular hole refers to radius.

T F 55. Dimension lines are generally equally spaced between views.

T F 56. Dimensions can be considered as directions for the workman.

T F 57. Numerals in dimensioning should be the same grade as extension lines.

T F 58. In dimensioning an arc of ⅛ in. radius, the arrowhead should be placed outside the arc, but touching it.

T F 59. For dimensions under ¼-in., the arrowheads and figures should be placed outside the extension lines.

Score: 58 items
Score equals number right = ...

Part II — The Geometry for Mechanical Drawing

Directions: There are 16 true statements, lettered from *a* to *q*. At the left of these statements are 23 terms. From these choose the term which best matches a statement and place its number in front of the statement. For example, the term which best matches statement *a* is *A regular polygon;* therefore, the number of the term (number 12) has been placed in front of statement *a*.

1. A regular octagon
2. A triangle
3. A perpendicular
4. Vertex
5. A regular hexagon
6. Parallelogram
7. A pentagon
8. Quadrilateral
9. An ellipse
10. A polygon
11. An isosceles triangle
12. A regular polygon
13. Equiangular polygon
14. A rectangle
15. A square
16. Parallel
17. A trapezoid
18. Diagonal
19. Hypotenuse
20. A tangent
21. Segment
22. An equilateral triangle
23. Perimeter

12 *a*) A general term for enclosed plane figures that are both equilateral and equiangular.
.. *b*) A name for all four-sided figures.
.. *c*) An enclosed figure of eight equal sides and angles.
.. *d*) A quadrilateral that is both equilateral and equiangular.
.. *e*) A line outside a circle, joining the circle at but one point and forming a 90-deg. angle with the radius drawn to the point of contact.
.. *f*) A polygon of three sides.
.. *g*) A figure inscribed in a circle by using the radius of that circle spaced six times on the circumference.
.. *h*) A line 90 deg. to a given line.
.. *i*) Two lines which would not meet, however far extended.
.. *k*) The outline of a polygon.
.. *l*) The part of an angle where the two sides meet.
.. *m*) An enclosed plane figure bounded by three or more straight lines.
.. *n*) A polygon of three equal sides.
.. *o*) A polygon having all angles equal.
.. *p*) A quadrilateral having its opposite sides parallel.
.. *q*) A parallelogram having its angles right angles.

Score: 15 items
Number right = ...

Part III — Geometric Problem Test

Directions: Complete the problems by use of compass and straightedge. Leave all construction lines on paper.

1. With line AB as a side, construct a hexagon.

A———B

2. Using AB as a long diameter, construct a hexagon.

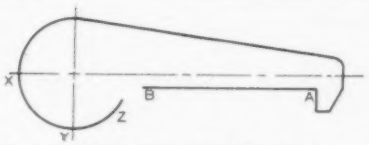
A———B

3. Construct a square on the base CD.

C———D

4. Construct a tangent to the circle O from an outside point P.

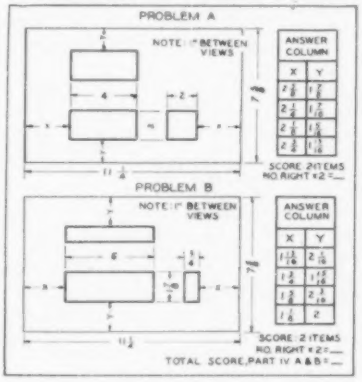
5. On the drawing of the pawl, construct a ¾-in. radius fillet tangent to line AB and to arc XYZ.



Score: 5 items. Number right × 3 = ...

Part IV — Computing Margins for a Three-View Orthographic Drawing

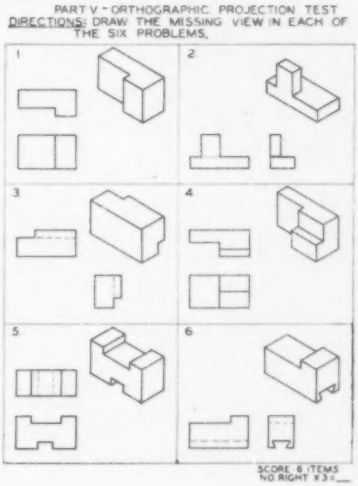
Directions: Assuming the three views are placed in the middle of a rectangle which measures 7⅝ by 11¼, figure the X margins and Y margins. The correct answers are in the answer column. Circle the figures that agree with your answers. Note that 1 in. is to be left between views. Do your figuring on a scrap piece of paper.

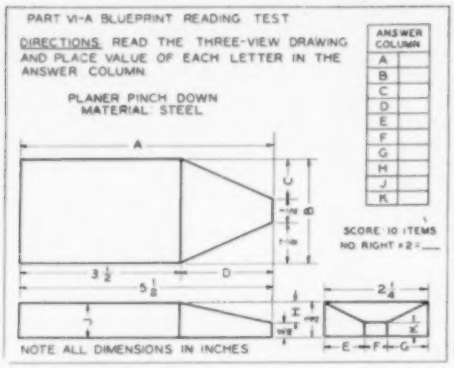


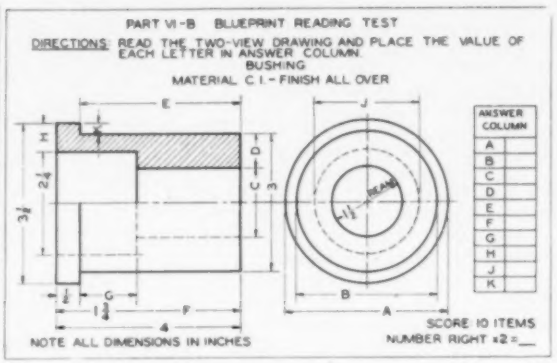
Score: 6 items. Number right × 3 = ...

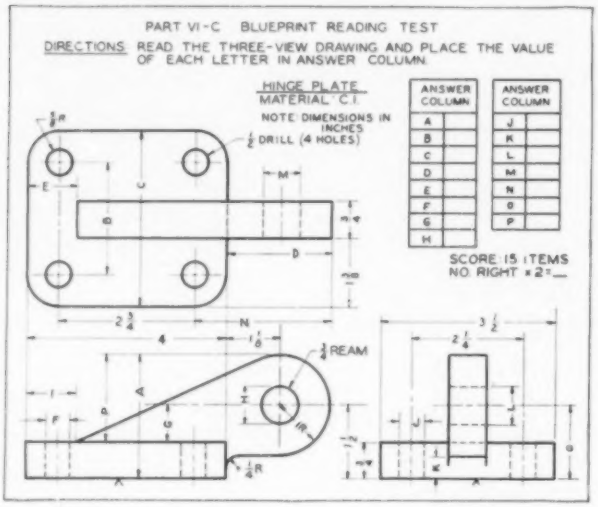
Part V — Orthographic Projection Test

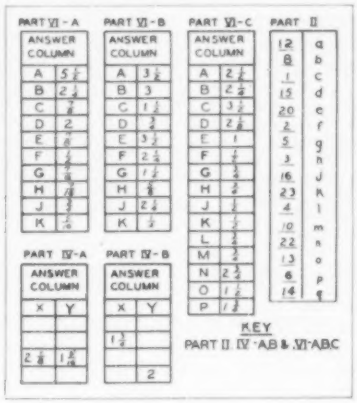
Directions: Draw the missing view in each of the six problems.







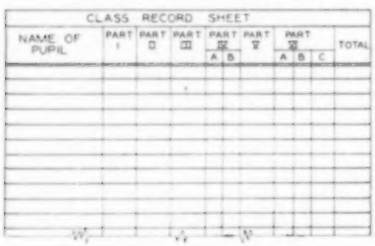




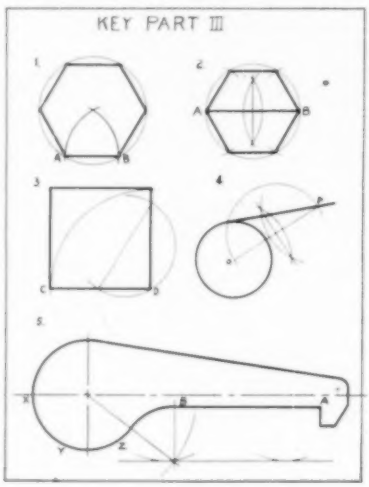
Key Part II, Part IV A and B and Part VI A, B, and C.

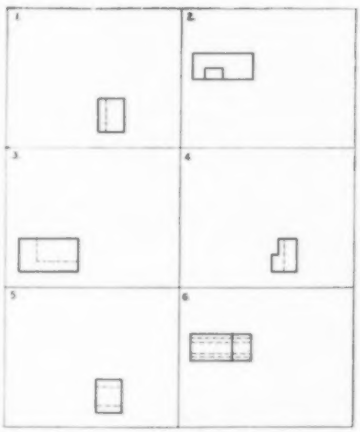
KEY — PART I

1.	11. F	21. F	31. F	41. T	51. F
2. T	12. T	22. F	32. T	42. F	52. F
3. T	13. T	23. T	33. T	43. F	53. T
4. F	14. T	24. F	34. F	44. T	54. F
5. F	15. F	25. T	35. T	45. T	55. T
6. F	16. T	26. T	36. T	46. T	56. T
7. T	17. F	27. F	37. F	47. F	57. F
8. T	18. T	28. T	38. F	48. T	58. T
9. T	19. F	29. T	39. T	49. T	59. T
10. T	20. T	30. T	40. T	50. F	



Class-record sheet





Key Part V

AIRCRAFT SOURCES OF ELECTRICAL POWER TEST

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Homewood School
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WILLIAM C. FORD
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General directions: Read each question carefully and answer as directed at the beginning of each part. This is not a test to see how fast you can work; it is a test to see how much you know. If you do not know the answer to a question, do not spend too much time on it, proceed to the next questions and then to the next part. Questions asked by students will not be answered after the examination begins. Are there any questions now? If not, begin.

Part I

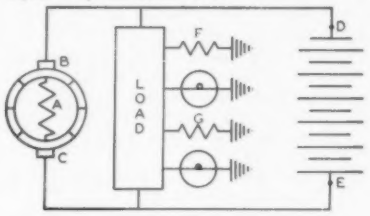
Directions: Some of the following statements are true and some are false. In each case write T on the left of the statement if you think the statement is true, or write F on the left if you think the statement is false.

( ) 1. The normal aircraft battery and generator systems are connected in parallel.
( ) 2. The speed of the engine driven generator is affected by the speed of the engine.
( ) 3. An increase in engine speed would increase the generator voltage if the generator voltage was not otherwise regulated.
( ) 4. The reverse current relay regulates the charging rate of the battery.
( ) 5. Contact points in the reverse current relay are held closed by a spring.
( ) 6. If the field circuit in a generator is open the generator will put out zero voltage.
( ) 7. A reverse current relay uses only one winding.
( ) 8. The reverse current relay does not always protect the generator from an overload.
( ) 9. With the finger type voltage regulator, maximum resistance is obtained in the field circuit when all the fingers are lifted from the bar.
( ) 10. The field of an alternator must be supplied with direct current.
( ) 11. Usually a dynamoter is used for supplying high voltage for radio equipment.
( ) 12. In a direct current generator the commutator is electrically connected to the armature shaft.
( ) 13. On a commutator, the mica between the segments should be cut as deep as the mica is wide.
( ) 14. When restoring residual magnetism to a generator it is not important which way the current flows through the field coil.
( ) 15. To restore residual magnetism it is necessary to remove the generator from the airplane.
( ) 16. The storage battery in an airplane should always be used for ground operation.
( ) 17. Crocus cloth should be used for seating generator brushes.
( ) 18. Under normal operating conditions the battery and the generator each supply an equal amount of current.
( ) 19. The main purpose of the voltage regulator is to protect the generator from overloading.
( ) 20. The carbon pile voltage regulator should be allowed to warm up if it has to be adjusted while in the airplane.

Part II

Directions: The following are sentences with missing words or phrases. Fill in the blanks with the correct words or phrases necessary to complete each sentence.

1. A .... is used to disconnect the generator from the power system when system voltage is lower than that of the battery.
2. An increase in the field resistance .... the field current which in turn causes the generator terminal voltage to be .....
3. A .... is usually incorporated in the generator circuit to disconnect the generator from the circuit in case of an emergency.
4. The .... is used to localize trouble in generator and motor armatures.
5. The loss of residual magnetism in a generator may be due to ...., ..., or .....
6. .... and .... should be used to neutralize acid or moisture on top of the battery.
7. Battery terminal voltage will increase as the charging voltage .....
8. The reverse current relay coil windings are called .... winding and .... winding.
9. Three advantages of the carbon pile voltage regulator are: a) ...., b) ...., c) .....
10. In the following diagram, battery voltage would be taken across points .... and ...., generator voltage across points .... and .... and generator armature resistance is designated by the letter .....



Part III

Directions: The meaning or association of the words in the upper column are to be found in the statements in the lower group. In the space to the left of each number write the letter of the statement in the lower group, which explains the meaning or association of that particular word.

.... 1. residual magnetism
.... 2. alternator field circuit
.... 3. generator field circuit
.... 4. alternator
.... 5. rectifier
.... 6. aircraft generator

a) Produces alternating current but brushes and commutator change it to direct current.
b) Field voltage, field current, and flux density are all constant.
c) Provides an initial start for voltage generation.
d) Shunt wound, external control, no field coil.
e) Changes alternating current to direct current.
f) Field voltage and field current vary.
g) Produces alternating current.

Part IV

Directions: Each incomplete sentence is followed by a group of words or phrases. Underline the correct words or phrase following each sentence which will complete that sentence.

1. To increase the voltage output when a carbon pile regulator is in use, it is necessary to: (*a*) adjust the rheostat; (*b*) adjust the carbon pile screw; (*c*) adjust the core locking screws; (*d*) adjust both the rheostat and the core locking screws.
2. Aircraft generator voltage is regulated by: (*a*) changing the generator armature speed as needed; (*b*) changing the number of field windings being used; (*c*) changing the number of conductors in the armature; (*d*) changing the field strength.
3. When testing an armature on a growler for a shorted coil, an induced current flow in the coil will cause: (*a*) the ohmmeter to show an increase in resistance; (*b*) the ohmmeter to show a decrease in resistance; (*c*) the hacksaw blade to be attracted more strongly; (*d*) the voltmeter to show a voltage drop.
4. A current regulator is used to: (*a*) maintain constant voltage output from the generator; (*b*) prevent overcharging of the battery; (*c*) prevent the generator from being motorized by the battery; (*d*) to prevent the generator from delivering an excessive amount of current.
5. In a direct current system where two generators and two carbon pile voltage regulators are used, the generators are synchronized through the: (*a*) field coil; (*b*) equalizer coil; (*c*) current coil; (*d*) compensating coil.

KEY AND SUGGESTED SCORING

Part I (1 point each)

1. T	11. T	
2. T	12. F	
3. T	13. T	
4. F	14. F	
5. F	15. F	
6. F	16. F	
7. F	17. F	
8. F	18. F	
9. T	19. F	
10. T	20. T	

Part II (3 points each blank)

1. reverse current relay
2. lowers, lowered
3. field switch
4. growler
5. generator standing idle, shock in landing, careless handling of generator

Part III (2 points each)

1. c
2. b
3. f
4. g
5. e
6. d

Part IV (1 point each)

1. a
2. d
3. c
4. d
5. b

(See next page)

6. bicarbonate of soda, water
7. increases
8. shunt or voltage coil,
series or reverse current coil
9. (a) less sensitive to vibration or shock, can be used on higher field current generators, (b) no movable contacts, thus less radio interference, and (c) regulation of output improved due to continuous resistance change in carbon pile
10. D and E
C and B
A

COMPREHENSIVE LEATHER-WORKING TEST

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Leatherwork has to a large extent been omitted from the industrial-arts curriculum of today. However, with the development of better texts and shop manuals, it is rapidly making its way into the industrial-arts program in many schools.

Leatherwork, taught as a craft in industrial-arts programs, lends itself as a good unit in the general-shop program or as a part of a laboratory of industries type of course. The ease of learning the skills and manipulations and the opportunity for more artistic creativeness, fulfills every need for a good industrial-arts course.

The increasing demand for leatherwork has caused many industrial-arts training colleges to add it to their curriculum. We can expect to see an increased demand for leatherwork in the future, especially in the junior high schools.

If leatherwork, like any other course, is to be taught, the teaching must be tested. By testing we can determine if the teacher has taught and if the pupil has learned. A good test will show the efficiency of the teaching effort as well as to what extent each student has mastered the subject.

The test should be thorough and complete, covering every important point of the subject. It should not only test the information acquired by the student but should test the manual skill developed by him as well.

A complete test for a unit in leatherwork follows:

Part I — True-False

Directions: At the beginning of each sentence a space is provided for either the letter *T* or *F*. If the statement is true, insert the letter *T*. If the statement is false, insert the letter *F*.

( ) 1. The best part of a hide or skin is the neck and flank.
( ) 2. Sheepskin always has the wool left on it.
( ) 3. Horsehide is a good tooling leather.
( ) 4. It is easy to identify unborn calfskin because the hair is always left on it.
( ) 5. Rawhide is the most carefully tanned leather.
( ) 6. Kangaroo leather is obtained from Australia.
( ) 7. Sheepskin has little tensile strength and is good only for linings, such as billfolds.
( ) 8. Horsehide is used when durability is required.
( ) 9. Leather is designated by its weight per square foot.
( ) 10. Chemical tanning is the method used in tanning skirting leather.
( ) 11. Chemically tanned leather is the best adapted to tooling.
( ) 12. Strap leather is bark tanned.
( ) 13. Hand tooling and hand stamping leather are two different operations.
( ) 14. Calfskin can be stamped at the factory to look like alligator or reptile.
( ) 15. The best leather to tool is Russian tooling leather.
( ) 16. Machine stamped and hand tooled leather cannot be distinguished between.
( ) 17. Calfskin can be hand tooled by the same method as cowhide.
( ) 18. One of the most important things in hand tooling leather is to have a good distinct design.
( ) 19. A leather stencil is a good method of transferring designs.
( ) 20. The cutting gauge is used to cut irregular curves.
( ) 21. A stitch marker is an essential tool to have when sewing on a machine.
( ) 22. Strap leather is bark or vegetable tanned. It is usually much stiffer and harder than chemically tanned leather.
( ) 23. The majority of chemically tanned leather is tanned with chrome chemicals.
( ) 24. Calfskin is used for harness leather.
( ) 25. The type of leather for certain articles is not always as important as the method used to tan it.
( ) 26. Suede leather is split leather or leather with either the flesh side or the hair side buffed.
( ) 27. The color of the hair on an animal will affect the color of the leather.
( ) 28. Leather should never be wet before making a bend.
( ) 29. A lining such as calfskin can be glued flesh side to flesh side and will hold so well that nothing else is required to hold it.
( ) 30. Kangaroo is a good leather for boot tops and lacings.
( ) 31. For the money, kid is the best material for lacing.
( ) 32. Kidskin and goatskin are one and the same.
( ) 33. Reptile is one of the strongest and most durable leathers on the market.
( ) 34. The cheapest and weakest animal leather is that obtained from sheep or goat.
( ) 35. The strongest leather for its weight is Kangaroo.
( ) 36. Calfskin is more durable than genuine alligator if it is to be bent.
( ) 37. The texture or quality of leather is grown into the hide before the animal is killed.
( ) 38. When leather is to be in contact with the weather it should be oil tanned.
( ) 39. The usual width of loop lacing for lacing large articles is 9/16 in.
( ) 40. Rivets are desirable fasteners for leatherwork when they are visible.

Part II — Completion Test

Directions: In each of the blanks below fill in the correct word or words.

1. The best method of telling artificial leather from genuine leather is to inspect the .... side of it.
2. A sewing awl is used in .... sewing.
3. Skirting leather is sold by the .....
4. The substance most used for chemically tanning leather is ....
5. Edges of leather can be finished beautifully by applying .... and rubbing it.
6. In hand sewing .... cord is used, about .... strands are twisted together and rubbed with ....
7. The best method of inspecting leather for quality is to look at both the .... and the .... of the leather.
8. To a layman the best method of inspecting the leather for quality is to look on the .... side of it.
9. In hand sewing .... needles are used.
10. Methods of fastening leather together are ....., ..., ..., ..., ... & .....
11. Before leather is tooled it should be dipped in ....; when it returns to its .... it is ready to be tooled.

Part III — Multiple Choice

Directions: In the following sentences, choose the part that makes the sentence correct and place the number in the parentheses to the left of each sentence.

Example: (1) The Amazon is a (1) river, (2) city, (3) lake, (4) desert, (5) mountain.

( ) 1. The marking gauge is used to (1) mark irregular curves, (2) mark straight lines, (3) draw designs on leather, (4) make convex curves, (5) mark lines parallel to an edge.
( ) 2. Leather is glued together (1) before sewing, (2) for edging, (3) for stenciling, (4) for tooling, (5) for skiving.
( ) 3. The best thing for marking on leather, is (1) the swivel knife, (2) the leather awl, (3) an ice pick, (4) a pencil, (5) a sewing awl.
( ) 4. When an article is hand-tooled it is usually retouched with stamping tools. They should be used (1) only on the center of a design, (2) at every place where there is room for one, (3) only on the outer part of the design, (4) very sparingly, (5) only to hide blemishes in the leather or workmanship.
( ) 5. The swivel knife is used to (1) cut out designs to be hand-tooled, (2) to cut thick leather, (3) to cut leather when making splices, (4) to cut round holes through the leather, (5) to cut diagonal lines.
( ) 6. The bevel tool is used to (1) stamp

the border, (2) smooth out lines and give them color, (3) bevel an edge, (4) make splices, (5) retouch hand-tooling.

( ) 7. The shading tool is used to (1) make the leather all one shade, (2) dye the leather, (3) stencil leather, (4) pound the leather and give it color, (5) stamp leather.

( ) 8. The skiving knife is used to (1) do heavy cutting, (2) cut lacing, (3) cut irregular curves, (4) cut off thin layers of leather, (5) be fastened in a gauge and cut straight pieces of leather.

( ) 9. The best method of cutting lacing is to (1) start at the center of the hide and cut straight pieces, (2) start at the outer perimeter of the hide and cut in circles around the hide, (3) start at the center of the hide cutting in circles until the outer perimeter of the skin is reached, (4) start out at the outer part of the skin and cut straight lacing, (5) cut diagonal pieces about ¼ in. across the skin.

( ) 10. When doing loop lacing with kidskin (1) all the holes should be punched before the lacing is begun, (2) only one hole is punched; it is laced and then another is punched, (3) about two to three dozen holes are punched, (4) about half of the holes are punched, (5) about six or eight holes are punched.

Part IV — Matching

Directions: You will be shown ten samples of leather showing both the flesh and grain side. The samples are numbered 1–10. Below you will find the names of different kinds of leather. Put the number of the sample in the blank provided at the left of its correct name.

Example: Sample No. 11 is rawhide, so place the number 11 in the space provided beside rawhide.

Instructor's note: A sample display board may be placed in plain view of all the class with samples of leather clearly numbered so that each member can see the types of leather and be tested on his ability to identify them.

11

.... rawhide
.... tooling cowhide (strap leather)
.... kangaroo
.... suede
.... kidskin
.... horsehide
.... an imitation leather
.... heavy calfskin
.... sheepskin
.... calfskin with an alligator grain stamped on it
.... pigskin
.... alligator leather
.... kip (the top split of cowhide)

Part V — Identification

Directions: Number your paper 1–15. Opposite each number write the correct name of the tool that is hung under that number on the board.

Instructor's note: Tools should be placed in such a way that the tool can be clearly associated with its number so that the student can be tested on his ability to identify the various tools.

Tools are hung on the board and numbered thus:

1. .... 1. swivel knife
2. .... 2. leather awl
3. .... 3. bevel tool
4. .... 4. skiving knife
5. .... 5. shading tool
6. .... 6. cutting knife
7. .... 7. cutting gauge
8. .... 8. background tool
9. .... 9. an edger
10. .... 10. a stamping tool
11. .... 11. an edge creaser
12. .... 12. a veining tool
13. .... 13. sewing awl
14. .... 14. snap setter
15. .... 15. rawhide mallet

VI. Objective Performance Test for Skill and Accuracy in Hand Tooling Leather

Directions to the pupil: This test is to determine how skillful and accurately you can use leatherworking tools and a test of your judgment in the selection of leather. You will hand-tool and finish a 1 by 3-in. piece of leather. All materials and tools will be furnished.

You will be given three pieces of leather from which to choose your sample. Choose the best piece; you will be graded on your choice. Definite instructions will be given in the procedure. Do not hurry but do not waste time: do the best work you can. You will be graded on skill in using different leather tools and correctness in their use, ability to choose the best piece of leather, accuracy of cutting, the finishing of an edge, and your ability to obtain a good effect in your tooling.

There is no time limit. The instructor will answer necessary questions as you go along. Read all instructions before beginning and when finished write your name on the back of the finished product and tie it together with all the pieces of leather that were furnished you, including the one you cut your your sample from and hand it in to the instructor.

Procedure

1. Select the best piece of leather from your selection of three.
2. From the piece of leather selected, cut the best piece of leather (1 by 3 in.) that you can get out of it.
3. Cut the border on the sample with a swivel knife.
4. Wet the leather and stencil it.
5. Swivel knife the design.
6. Allow the leather to dry to the proper moisture for tooling.
7. Bevel the design.
8. Background the design.
9. Shade the design.
10. Retouch the tooling with a swivel knife.
11. Retouch the design with stamping tools.
12. Edge the sample with the edger tool.
13. Crease the edge with the creasing tool.
14. Finish the edge with liquid wax.

Things to be tested

Per cent	*Score*
10	1. Selection of the best piece of leather.
10	2. Selection of the best cut, out of the piece of leather.
5	3. Accuracy in cutting to a given width and length.
5	4. Skill in stenciling.
5	5. Test the correctness of beveling and the skill in the use of the beveling tool.
5	6. Accuracy and skill in the use of the swivel knife.
10	7. Ability to tell when leather is at the right moisture for tooling.
5	8. Test skill in interpreting designs.
5	9. Test skill in the use of the background tool.
5	10. Test skill in using the shading tool and of obtaining the maximum color with it.
5	11. Test skill in retouching with a swivel knife.
5	12. Test his skill in obtaining the proper effect with stamping tools.
5	13. Test his ability to obtain the proper effect by retouching.
5	14. Test skill in the use of the edge creaser.
5	15. Test skill in the use of the edger.
5	16. Test ability to finish and edge clean and smooth with liquid wax.

KEY TO OBJECTIVE INFORMATION TEST

Part I — True-False Test

1. F	11. F	21. F	31. T
2. F	12. T	22. T	32. F
3. F	13. T	23. T	33. F
4. F	14. T	24. F	34. T
5. F	15. T	25. T	35. T
6. T	16. F	26. T	36. T
7. T	17. T	27. F	37. T
8. T	18. T	28. F	38. T
9. T	19. T	29. T	39. T
10. F	20. F	30. T	40. F

Part II — Completion Test

1. Flesh
2. Hand
3. Pound
4. Chrome chemicals
5. Liquid wax
6. Linen, five, beeswax
7. Flesh side, hair side
8. Flesh
9. Two
10. Snaps, rivets, lacing, gluing, sewing, plaits
11. Water, original color

Part III — Multiple Choice

1. 5	3. 2	5. 1	7. 4	9. 2
2. 1	4. 4	6. 2	8. 4	10. 5

Project Rating Scale for Leatherwork

The following are items to be rated in grading projects in leatherwork. Each item is followed by a percentage value.

	Per Cent Value
1. Design	10
2. Utility	10
3. Choice of material	10

4. Construction	15
5. General appearance	10
6. General workmanship	20
7. Finish	5
8. Accuracy in cutting, construction, design, lacing, sewing	5
9. Finished product compared with material started with	5
10. Cleanliness	5
11. Assembly	5

AIRCRAFT STARTERS AND MOTORS TEST

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General directions: Read each question carefully and answer as directed at the beginning of each part. This is not a test to see how fast you can work; it is a test to see how much you know. If you do not know the answer to a question, do not spend too much time on it, proceed to the next questions and then to the next part. Questions, asked by the students, will not be answered after the examination begins. Are there any questions? If not, begin.

Part I

Directions: Some of the following statements are true and some are false. In each case write T on the left of the statement if you think it is true, or write F on the left if you think the statement is false.

( ) 1. It is of major importance how long and how fast a starter will turn the engine.
( ) 2. Inertia starters incorporate a speed reduction gearing.
( ) 3. The cartridge starter uses a small flywheel and an electric motor for energizing.
( ) 4. The direct cranking starter and the cartridge starter use only a very small amount of current for operation.
( ) 5. In the combination electric inertia-direct cranking starter, the motor cranks the flywheel and the engine jointly only after the starter has been engaged.
( ) 6. The direct cranking starter will turn the crankshaft faster than any other type starter.
( ) 7. The direct drive starter is engaged automatically once the starter switch is turned on.
( ) 8. An inertia starter is used on large engines because of the starting torque it can develop.
( ) 9. An inertia starter should not be tested at full voltage unless there is a load upon it.
( ) 10. The breech pin is an electrical contact for the cartridge type starter.
( ) 11. A direct current motor could be used as a generator.
( ) 12. To determine the direction of rotation of a generator, the left-hand rule should be used.
( ) 13. The speed of a shunt wound motor is fairly constant under changing load.
( ) 14. The shunt motor will operate only on direct current.
( ) 15. Sealed bearings on generators and motors should be lubricated after each 100 hours of operation.
( ) 16. Emery cloth should be used when cleaning the commutator.
( ) 17. The meshing solenoid permits the starter flywheel to begin gaining momentum.
( ) 18. To disengage the starter dog from the engine the starter switch should be operated.
( ) 19. Too many unsuccessful attempts in rapid succession at starting, may cause the starter flywheel to burn out.
( ) 20. In a shunt wound motor the armature windings are subject to damage from overheating when the load on the shaft becomes excessive.

Part II

Directions: The following are sentences with missing words or phrases. Fill in the blanks with the correct words or phrases necessary to complete each sentence.

1. The four main types of starters are ....., ..., ..., and .....
2. To provide a means of electrically engaging the starter to the engine on hand-electric inertia starters, it is necessary to use a .....
3. The simplest of all starters is the .... type.
4. After operation of the cartridge starter the breech should not be opened until any .... is released.
5. To determine the direction of rotation of a motor the .... hand rule is used.
6. The speed of a series motor is controlled by the .... and should this be removed the motor will .....
7. The compound wound motor combines the characteristics of the .... and the .... motors.
8. Motors that must be started through a resistance or what is called a starting box, are .... motors.
9. Insulators between commutator bars are made of .....
10. Excessive sparking at brushes may be caused by .... and .....
11. Oil on the clutch plates of a starter would cause the clutch to .....
12. A starter box or resistance is used to limit the current going to the .... of some motors when the motor is being started, or until it has attained its rated speed.

Part III

Directions: The meaning or association of the words in the upper column are to be found in the statements in the lower group. In the space to the left of each number write the letters of the statement in the lower column, which explains the meaning or association of that particular word.

.... 1. inertia starters
.... 2. direct cranking starters
.... 3. combustion or cartridge starter
.... 4. armature ground test
.... 5. armature open test
.... 6. armature short test
.... 7. combination electric inertia-direct cranking starter

a) Will seem to "hum."
b) An increase in pressure supplies the power for operation.
c) Similar in operation to automobile starters.
d) Will show breakdown of insulation between windings.
e) Indicates breakdown of insulation between windings and metal case or shaft.
f) Motor continues to crank flywheel after starter is engaged to engine.
g) Energy stored in rotating flywheel, cranks engine only few number of turns.
h) Shows only shorts between commutator and segments.
i) Shows breaks in armature windings.

Part IV

Directions: Each incomplete sentence is followed by a group of words or phrases. Underline the correct words or phrases following each sentence which will complete that sentence.

1. Under normal conditions, a direct cranking starter should not be used for a period longer than: (*a*) 15 seconds; (*b*) 1 minute; (*c*) 2 minutes; (*d*) 30 seconds.

2. A clutch is incorporated in a starter: (*a*) to protect the crankshaft drive in case the crankshaft fails to turn; (*b*) to protect the starter when it is being energized; (*c*) to protect the starter when meshing is taking place; (*d*) to slow down the flywheel speed when starter is energized for an excessively long period.

3. An inertia starter electric motor is: (*a*) series wound; (*b*) shunt wound; (*c*) compound wound; (*d*) differential compound wound.

4. An inertia starter motor may draw, when starting, approximately: (*a*) 10 amperes; (*b*) 40 amperes; (*c*) 100 amperes; (*d*) 300 amperes.

5. A windshield wiper motor should have: (*a*) a varying speed according to size of wiper arm; (*b*) a high starting torque; (*c*) a starting box to limit current flow; (*d*) alternating current for operation.

6. A starter solenoid should be installed: (*a*) anywhere in the starter system; (*b*) as close to starter switch as possible; (*c*) next to the starter if possible; (*d*) as close to the power bus as possible.

KEY AND SUGGESTED SCORING

Part I (1 point each)

1. T	5. T	9. T	13. T	17. F
2. T	6. F	10. T	14. T	18. F
3. F	7. T	11. T	15. F	19. F
4. F	8. T	12. F	16. F	20. T

Part II (3 points each)

1. inertia, direct cranking electric, combination electric - inertia and direct crank, and 3. cartridge
2. combustion or cartridge
2. meshing solenoid

4. pressure
5. left
6. load, overspeed
7. series, shunt
8. shunt
9. mica
10. improper seating, scored commutator or improper tension (any two)
11. slip below actual setting
12. armature

Part III (2 points each)
1. g 2. c 3. b 4. e 5. i 6. d 7. f

Part IV (2 points each)
1. d 2. c 3. a 4. d 5. b 6. d

Problems and Projects

PLAY PEN

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The two main advantages of the play pen described and illustrated herewith are that it is possible to move the pen from room to room without folding, and it will also act as an extra baby's bed, since it will accommodate a standard six-year-old size mattress. When traveling, this last feature is of great importance.

The play pen, mounted on two-inch rubber casters, is completely assembled with corner irons. A single screw in the corner iron on the ends acts as a very sturdy pivot.

The locks are held in place with four countersunk screws.

SIMPLE COMPASS IN MODERN DESIGN

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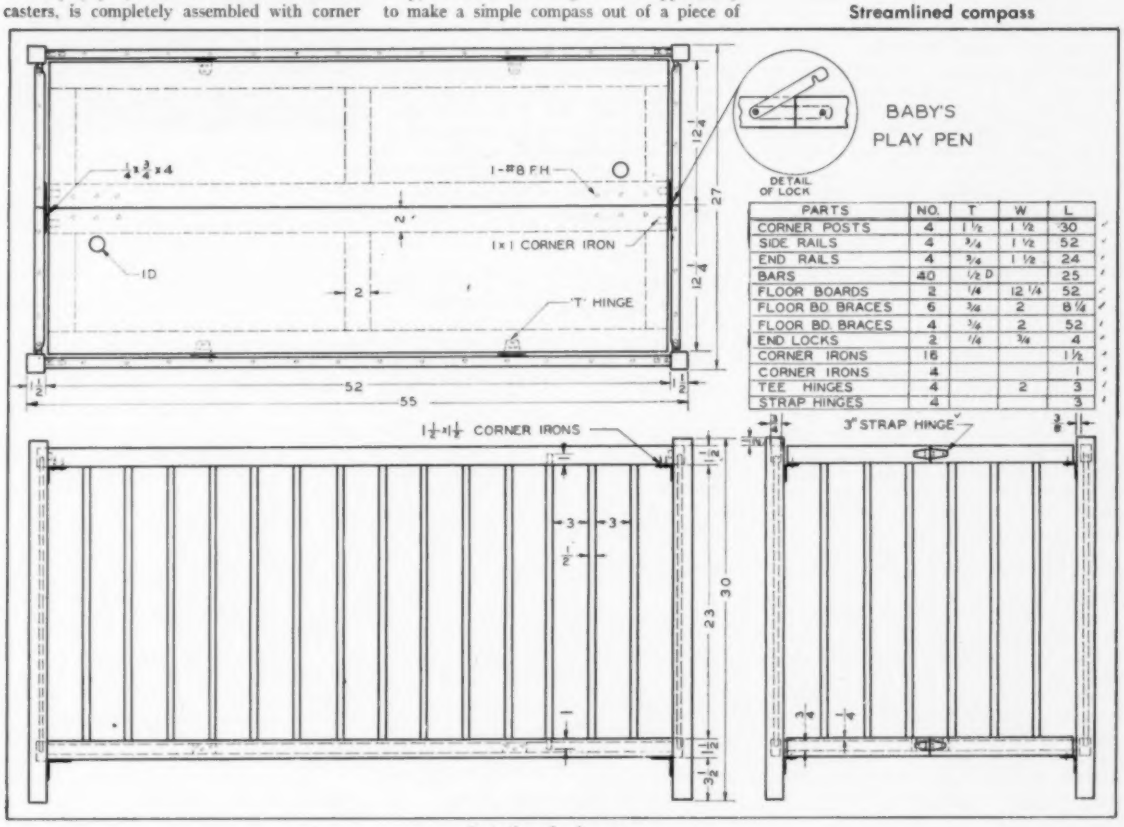
This article shows how the conventional simple compass can be given a modern design. Usually in the electrical course in the general shop, the students are given the opportunity to make a simple compass out of a piece of hard steel such as a used hack saw blade, or a piece of clock spring, mounted on a suitable base made of wood or some nonmagnetic metal.

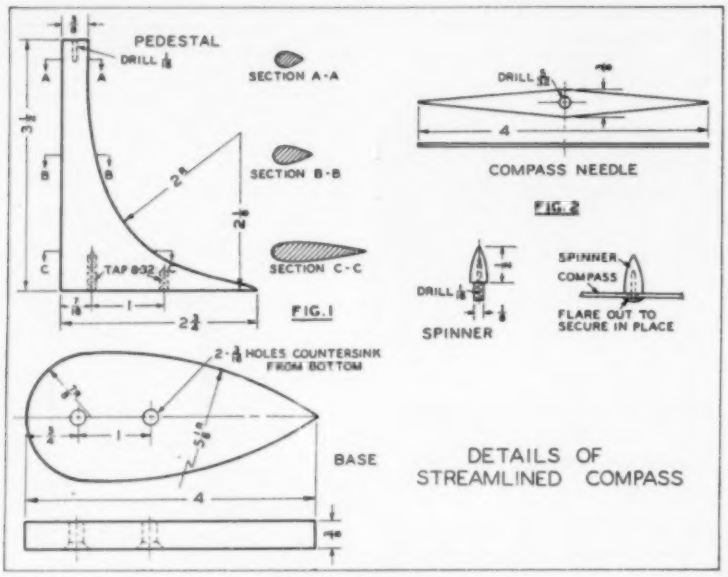
Using these same mediums, hack saw blade, aluminum base, brass for the spinner and a nail for the pivot, the project can be converted into an object of striking beauty. The resulting product possesses smart lustrous features characteristic of aeronautical lines and trends.

The base and pedestal are shaped from ⅛-in. aluminum, the compass needle from an

Streamlined compass



Details of play pen



Details of compass

old hack saw blade, the spinner from a brass rod, and a nail is used for the pivot.

Proceed by transferring the pattern of the base and pedestal to the aluminum stock, and then cut out with a hack saw. File the edges of the base smooth and round the top edges. Bring to a smooth finish with fine grades of emery cloth and then buff with rouge buffing compound. The general shape of the pedestal is cut out with a hack saw and then brought to a streamlined teardrop effect by filing. Scribe center lines along the front edge and also the sweep back. These will serve as guides in removing the same amount of material from each side. Use a flat file to remove the excess metal, and finish with a half round file along the sweep back. Finish with abrasive cloth and then buff. The pedestal is secured to the base with two 8–32 machine screws, as shown in Figure 1.

The compass pattern is transferred to the hack saw blade, and then the excess material is removed on a grinding wheel. Smooth all edges and then polish and buff. The spinner is turned from a small piece of round brass rod, as shown in Figure 2.

The compass needle and the spinner were silver plated to retain the same metallic appearance as the pedestal.

A small nail is turned to a sharp point and then force fitted into the top of the pedestal.

The compass needle is magnetized by stroking it first across the north magnetic field of a strong electromagnet, and then the opposite end across the south magnetic field. Test the compass with a bar magnet for polarity, and also check its accuracy with a commercial compass. The north end of the needle may be given a touch of black paint to designate it as the north pole.

The compass may be used in the shop to test the polarity of student made projects, and it may also serve as an incentive for the students to attempt modern design in other projects which they make. This type of pedestal can also be utilized for many other purposes, and could well be adapted as a mount for small aeronautical projects.

BOOK END

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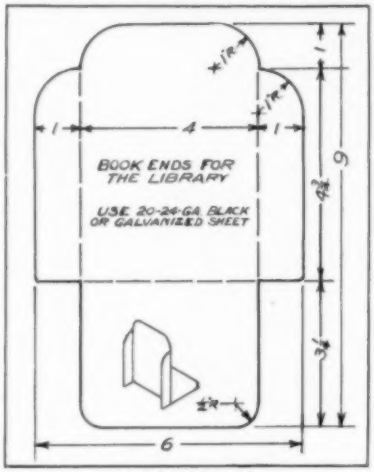
This pattern makes a very useful, easily made book end at low cost. Its appearance may be improved by lacquering. Apply decals if desired. Most school libraries need a number of these. Class production to fill all needs for such purposes in the school might be organized. No elaborate equipment is required. It is an excellent project for shops having little metalworking equipment.



Metal book end

MAGAZINE END TABLE

JOHN H. PIKUS
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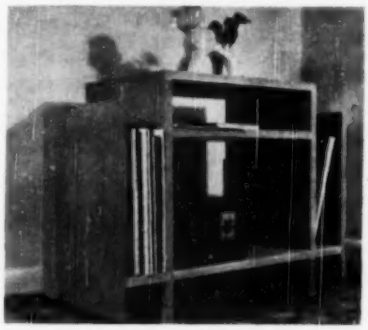
Los Alamos, N. Mex.

This attractive modern magazine end table is an excellent project for high school woodworking classes for teaching the jointing, gluing of stock, and the basic machine operations on the variety or circular saw. The usefulness and appearance of this project appeals to the average student and serves to motivate the learning process.



Magazine end table

White oak was used throughout in the construction of this project but either walnut or mahogany may be used. If walnut or mahogany are used a pleasing effect may be obtained by bleaching to produce the light finish found on modern furniture.

As a finish, apply one coat of clear varnish for the first coat, and allow it to dry thoroughly. A white filler or white lead in linseed oil is then applied and the excess wiped off across the grain. When thoroughly dry a coat of paste wax is then applied to complete the finish.

BILL OF MATERIALS

No. of Pcs.	*Name*	*Size*
1	Top	¾ x 13⅜ x 19½
1	Base	¾ x 13⅜ x 28
2	Sides	¾ x 13⅜ x 16
2	Magazine ends	¾ x 13⅜ x 17½
2	Legs	¾ x 4 x 13⅜
1	Top shelf	¾ x 13⅜ x 18¾
4	Corner blocks	¾ x 1 x 9
16	F.h. wood screws	No. 10 x 1½
6	F.h. wood screws	No. 10 x 2

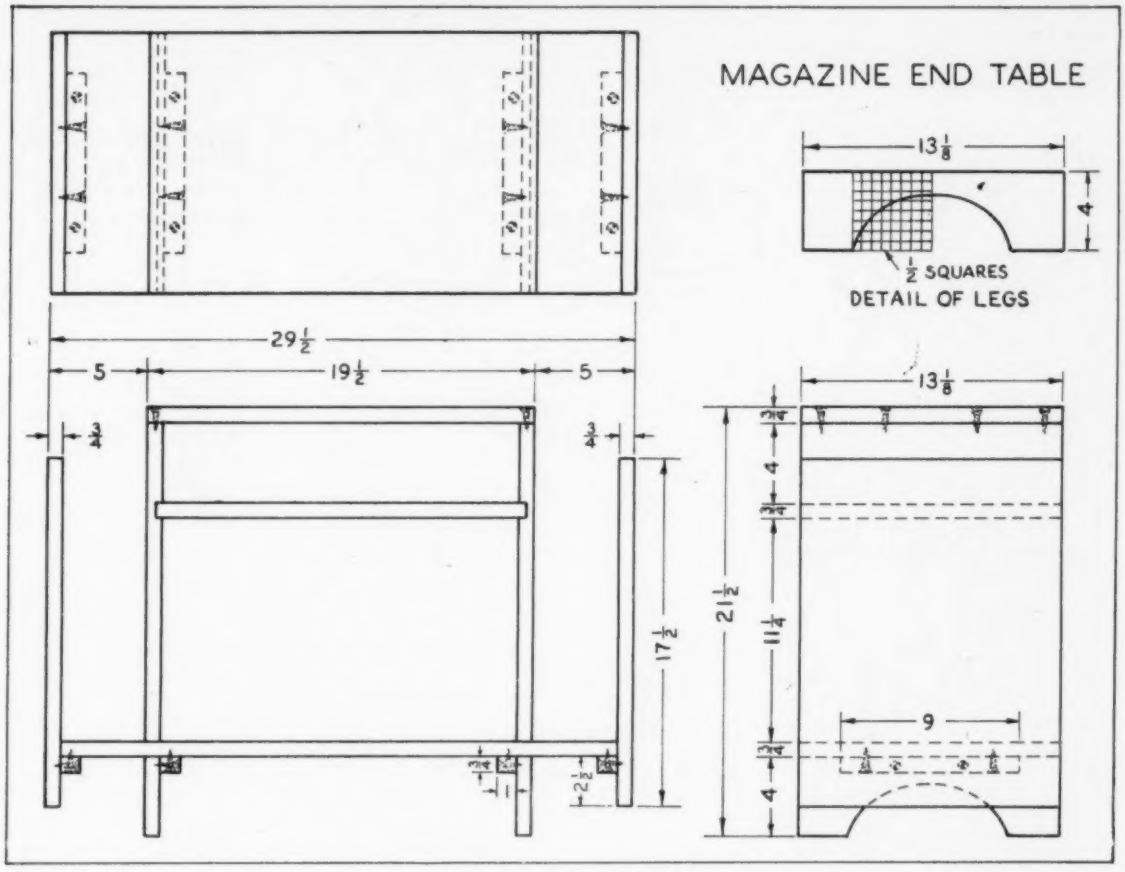
Method of Procedure

1. Select stock and cut to proper lengths, allowing extra stock for squaring.

2. Joint edges of stock for each panel on jointer, matching grain for direction and for pleasing appearance.

3. Apply glue to edges of stock for each panel and clamp with cabinet clamps.

4. When glue has set properly, plane both faces of each panel level and smooth.



Details of magazine end table

5. Square each panel to dimensions on variety or circular saw.

6. Lay out and cut out legs to shape on band saw.

7. Lay out and cut the dadoes on the two side panels to fit the shelf.

8. Sand all panels smooth with power sander.

9. Drill holes in top for flathead wood screws and for the plugs.

10. Assemble the top, the end pieces, and top shelf, applying glue to the butt joints and the dadoes.

11. The base is now attached to the panels assembled in step 10. Use glue and flathead wood screws.

12. Drill and countersink holes in the corner blocks and attach the magazine ends to the ends of the base, using glue on the corner blocks.

13. The legs are now fastened in place with glue and wood screws.

14. Finish sand the entire project and apply the finish as described above or apply some other finish if desired.

WOODWORKING LATHE

OTTO NORTHQUEST and HERBERT BELL
Pulaski High School
Milwaukee, Wis.

As a metal project, the wood lathe herein described, can be made by the average second or third semester metal student. It is devised and proposed to challenge the student all the way and when finished, he will not only have a machine that has a professional appearance, but one that will give him hours of enjoyment as he works on it in his home workshop. This lathe can be used for between center turning, faceplate work, and sanding disk work with table bracket as shown in Figure 1. It may also be used as a grinder by reducing the pulley shaft to ½-in. diameter and threading it so that flanged washers may be held on either side of the grinding wheel. The opposite end of the pulley shaft may also be threaded to receive a drill chuck.

At Pulaski High School several small ma-

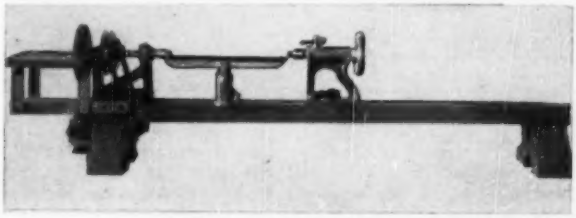


Fig. 1. Woodworking lathe with sanding disk at left end

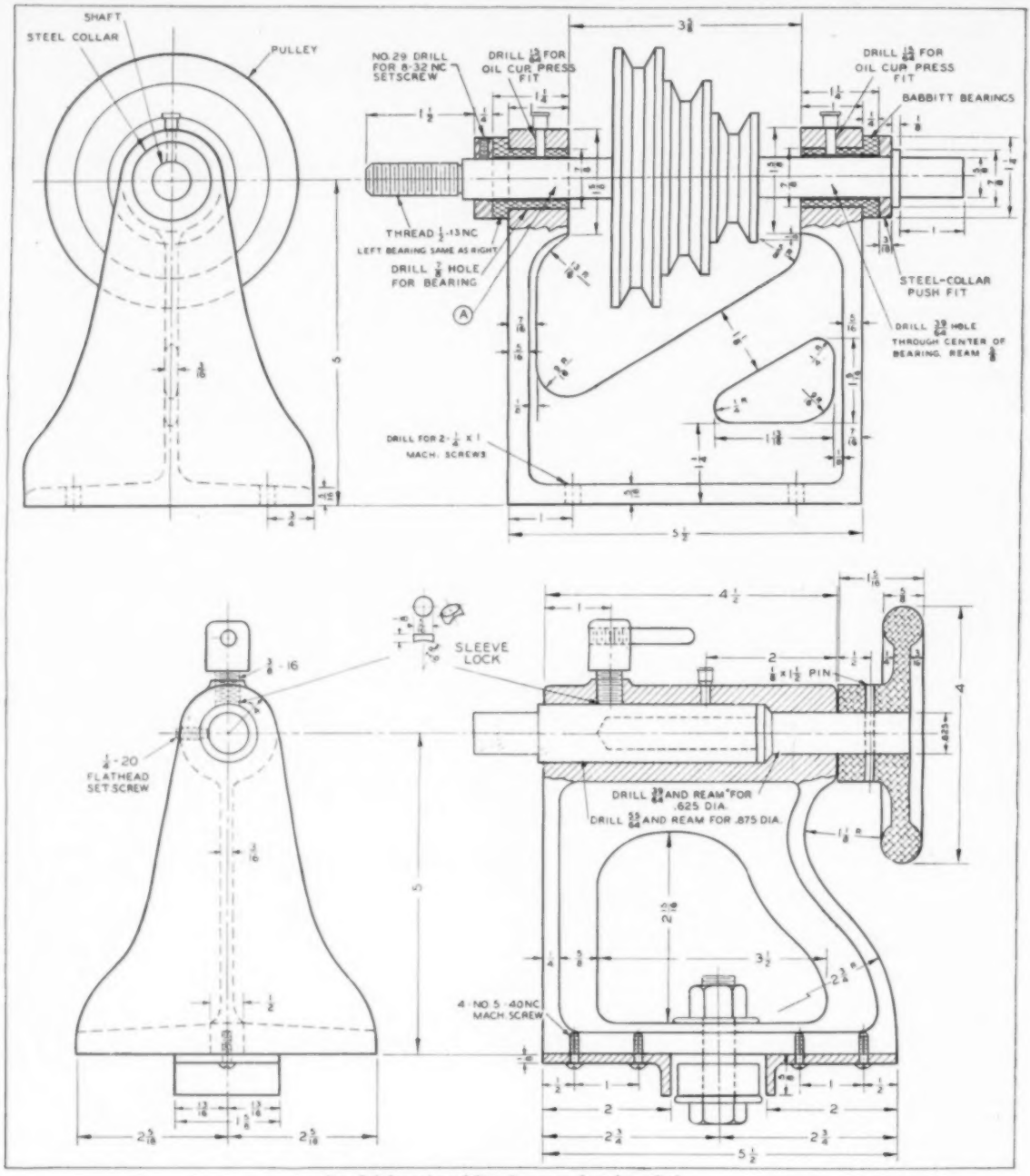

SHAFT
STEEL COLLAR
PULLEY
NO. 29 DRILL FOR 8-32 NC SETSCREW
DRILL 15/64 FOR OIL CUP PRESS FIT
DRILL 15/64 FOR OIL CUP PRESS FIT
BABBITT BEARINGS
THREAD 1/2-13 NC
LEFT BEARING SAME AS RIGHT
DRILL 7/8 HOLE FOR BEARING
STEEL-COLLAR PUSH FIT
DRILL 39/64 HOLE THROUGH CENTER OF BEARING. REAM 5/8
DRILL FOR 2-1/4 X 1 MACH. SCREWS
SLEEVE LOCK
3/8 - 16
1/4 - 20 FLATHEAD SET SCREW
5/8 X 1 1/2 PIN
DRILL 39/64 AND REAM FOR .625 DIA.
DRILL 55/64 AND REAM FOR .875 DIA.
4 - NO. 5 - 40 NC MACH. SCREW

Fig. 2 (above) and Fig. 3 — woodworking lathe

chines are made in the metal shop, namely, a drill press, small table saw, a grinder, and a jig saw. Several boys, however, were interested in a wood lathe so several lathes were made, each one different and each succeeding one an improvement over the preceding one. It became plain that we needed a casting for the headstock and one for the tailstock. Thereupon, the drafting department designed a wood lathe, and from the drawings patterns were made. The castings were then ordered from a local foundry, after which the metal shop completed the job.

The bed of the lathe is built up of 3/16 by 2 by 2-in. angle iron. The feet on either end

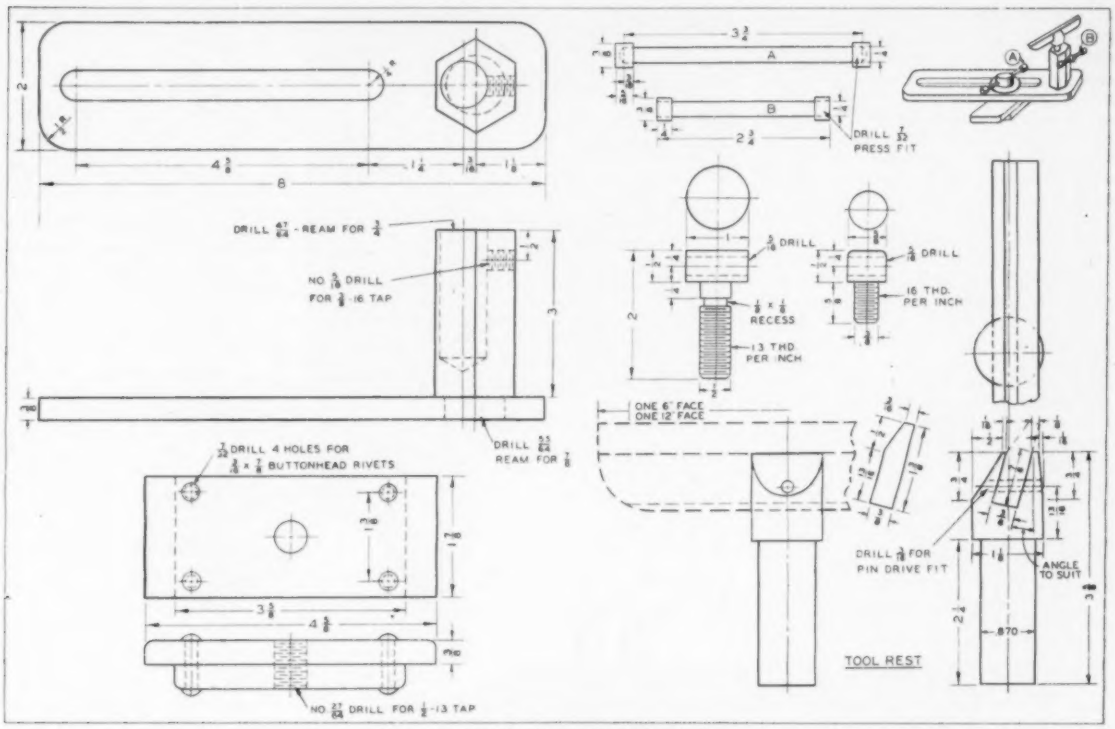

DRILL 7/32 PRESS FIT
DRILL 5/16
5/8 DRILL
16 THD. PER INCH
13 THD. PER INCH
ONE 6" FACE
ONE 12" FACE
DRILL 3/8 FOR PIN DRIVE FIT
ANGLE TO SUIT
TOOL REST
DRILL 4 HOLES FOR 3/8 x 7/8 BUTTONHEAD RIVETS
DRILL 53/64 REAM FOR 7/8
NO 27/64 DRILL FOR 1/2-13 TAP

Fig. 5. Details of woodworking lathe

are made of 2-in. hardwood. These blocks can usually be furnished by the boys and thus reduce the cost. The top surfaces of the angles are buffed to give a smooth surface.

The base of the headstock is then filed true and checked on the surface plate. The centers are located with the surface gauge and dividers, center punched and center drilled. The holes for the pulley shaft are drilled in the lathe by having one end supported on the dead center while the drill supports the other end. The casting rests on the compound rest while being drilled. When one bearing hole is finished the casting is turned end for end and the other hole is then drilled. Four small holes are then drilled into the sides of each bearing to aid in locking the babbitt in place. The bearings are then poured, after which they are drilled and reamed to receive the shaft. To provide a thrust bearing on either end of the headstock a shallow ring 1¼ in. in diameter is centered over the shaft hole. This permits the babbitt to overflow, forming an end-thrust bearing which is later milled square to fit the flange on the shaft.

The shaft is made from a piece of 7/16-in. cold rolled steel. To save on stock a steel ring is faced, drilled, reamed, and then turned to a 1¼-in. diameter to match the babbitt thrust bearing. This ring is pressed on the shaft and soldered against the flange turned on the shaft. The right end of the shaft is turned to 5/8 in. for the spur center. The left end of the shaft may be turned down for a grinding wheel, or threaded to fit a drill chuck or turned to receive a sanding disk. See Figures 2 and 4.

The base is drilled to receive two lag screws and two cap screws. Oil cups are pressed into position.

The tailstock is similarly faced and drilled

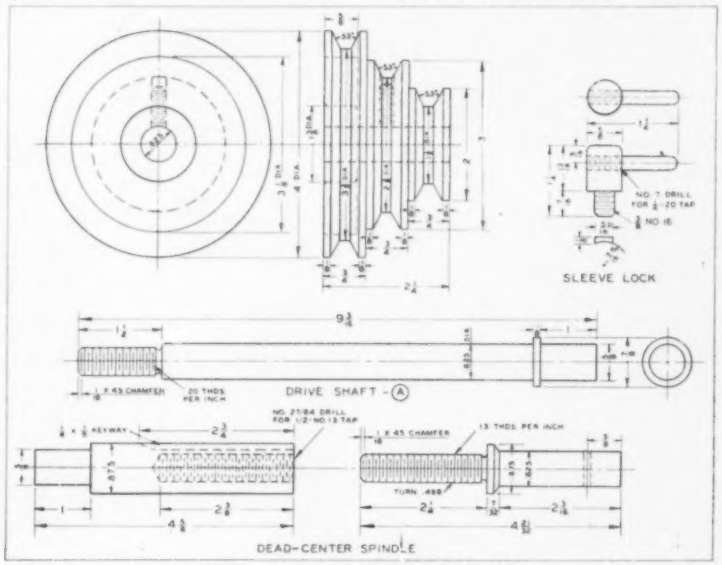


Fig. 4. Details of woodworking lathe

as shown in Figure 3. To prevent the spindle from turning as it is moved back and forth by the hand wheel, a 1/8 by 1/8-in. slot is milled parallel to the axis. See Figures 3 and 4. The slot must be as long as the screw will permit travel. A screw is then shouldered to fit this slot and the hardened outer end is shouldered to receive the dead center. The hand wheel is cast in aluminum and fitted on the screw and held in place with a 1/8-in. pin.

To lock the spindle in place the boss on top of the tailstock is drilled and tapped and then fitted with a 3/8–16 screw shown in Figure 3. To protect the spindle from being marked every time the screw is tightened a sleeve lock, shown in Figure 4, is fitted to the curvature of the spindle before inserting the screw.

To keep the tailstock in position and in alignment on the bed, two pieces of 1/8-in. angle iron are screwed to the bottom as shown in Figure 3. The width of these angles is determined by the space between the angles used for the bed. A square block is fitted, drilled, and brazed or welded to the bolt. This arrangement does not permit the bolt to turn when the nut is tightened.

The tool rest assembly is made as per Figure 5. Two rests are made; one 6 in. and one 12 in. in length. The post is slotted to fit the horizontal rest. After fitting the pieces, they are drilled and then riveted. By the use of a blowtorch this assembly is sweated together with soft solder. Welding or brazing would do a better job, but solder was found to be sufficiently strong. The slot in the plate is milled by using an end mill. To strengthen the plate the slot is not cut through to the end.

The time necessary to complete this project by the average boy is two semesters. A boy who does not possess average ability should be discouraged as each part made must be correct and in many instances tolerances must be held to close limits.

INDIAN SILVERSMITHING

BEN HUNT

Hales Corners, Wis.

(Continued from page 35 of the January, 1949, issue)

Dragonfly Brooch

The dragonfly brooch described in this article is rather elaborate and somewhat complicated, but once finished, it is a beautiful piece of jewelry. Of course, it can be made without the turquoise and it will even then be an attractive pin. The small stones and the large body stone used on this pin were shaped on a carborundum wheel and finished with a sandpaper stick. They were then polished with tin oxide.

It should be noted that three kinds of solder were used, the easy flowing, the medium, and finally Handy & Harmon's Easy Flow for soldering the parts of this pin together. However, if the Easy Flow solder is not at hand, put rouge on the soldered parts nearest the points where the last soldering is to be done.

Method of Procedure

1. *Hammer and file the body.* In this case a piece of half-round wire was used to start with. See Figure 1, Plate 33.

2. Solder the crescent shaped end and file it to shape, as shown at 1 in Plate 33.

3. Cut out the wings and stamp them, as shown at 2.

4. Determine size of large bezel and file a flat base for it on the body, as shown at 3, Plate 33.

5. Solder the wings to the body with medium hand solder.

6. Make such other bezels as are required.

7. Make eyes. If you have small stones, solder small bezels to strip of silver. If not, solder two raindrops on strip for eyes as shown at 5, Plate 33. Use medium hard solder.

8. Bend eye piece strips to fit around body.

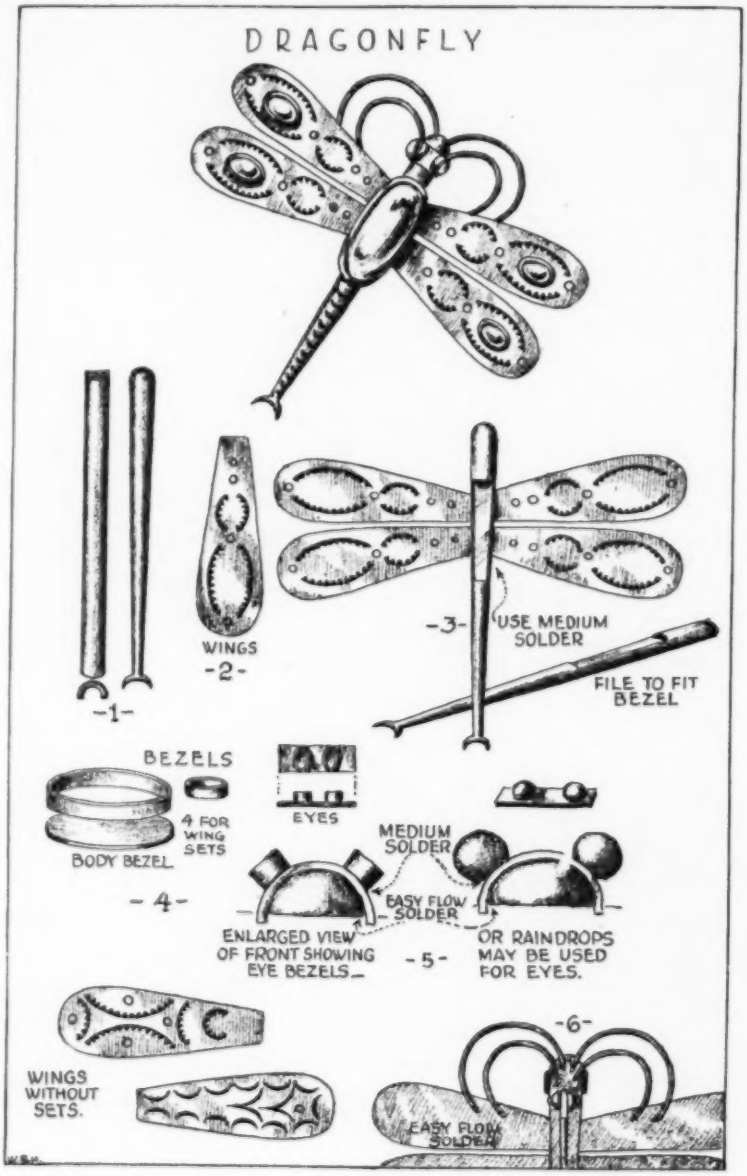


Plate 33

If necessary, file to get a good snug fit. Let the ends project until after soldering and then file them flush.

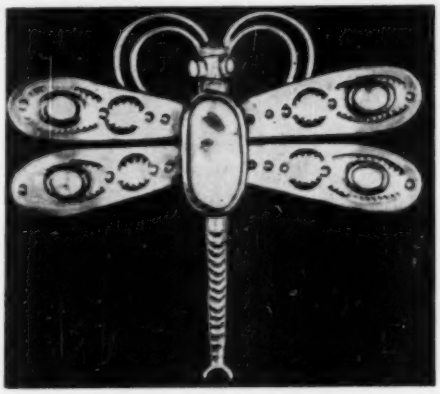
9. Solder eyepiece and wing bezels in place with easy flowing solder. Body bezel should be soldered together with medium hard solder and then soldered to the body, in the same operation, with easy flowing solder.

10. Shape feelers. Lay the dragonfly bottom up, on a charcoal block. Scoop out a depression for the body bezel, so that the parts will lie quite flat.

11. Solder the feelers and pin in one operation. Place something under the feelers to get them to lie level. A piece of charcoal or asbestos will do the trick. Use Easy Flow solder if you have it, or rouge the soldered parts near the last soldering.

12. Set the stones.

13. Give the entire pin a final polish.



Dragonfly brooch

STOUT STUDENTS BUILD A HOUSE

K. T. OLSEN
Assistant Professor
The Stout Institute
Menomonie, Wis.

Housing is of great concern to most of us. To acquire "on the job" experience, the carpentry classes at The Stout Institute are building a model house planned to meet the needs of a small family.

The numerous problems connected with the actual construction of a house have probably stumped many teachers. Perhaps the biggest hurdle is financing. Loan companies are reluctant to forward the necessary funds to meet the immediate expenses necessary to run the job. Lumber companies are sometimes willing to furnish all the lumber and millwork required. This method has been used on previous "Stout built" houses. Another possibility is having a future owner take care of all expenses. The writer has had several experiences which show the disadvantages of this method. Many compromises must be made as the house progresses in material and speed of construction.

The owner's chief objective is to get the most at the lowest cost, and in the shortest possible time. From the teacher's standpoint, this is an unfavorable situation. The most desirable procedure seems to be to have the school forward the money as needed until the house is completed and sold. If the school does not have funds immediately available, as was the case at Stout this year, the instructor may wish to finance the job himself. Thus, he can avoid many of the delays caused by changes and substitutions which are bound to occur during present-day construction. In any case, he will need to keep an accurate account of all expenses over the entire period of construction. The present estimate of the cost of the rough lumber and millwork of the Stout model house is approximately $2,500.

The next problem to confront the instructor is the securing of a building site. The lot should be close to the school if possible to avoid daily waste of time in transporting students to and from the job. In our particular case, the problem was solved by using vacant school property across the street from the carpentry shop. A local house moving contractor was consulted, and arrangements made to have the house moved to its permanent site upon completion and sale.

The material for our house is being secured through the co-operation of local lumber dealers. Although some of the dimension lumber is somewhat "green," it will have sufficient time to cure before being covered. Kiln-dried school lumber will be used for the millwork.

The Stout model house has a total floor

Fig. 1 — staking out the house

Fig. 2 — floor joists

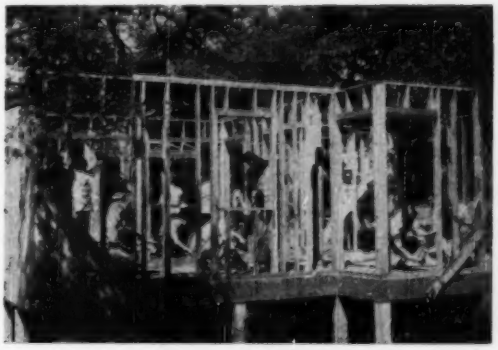
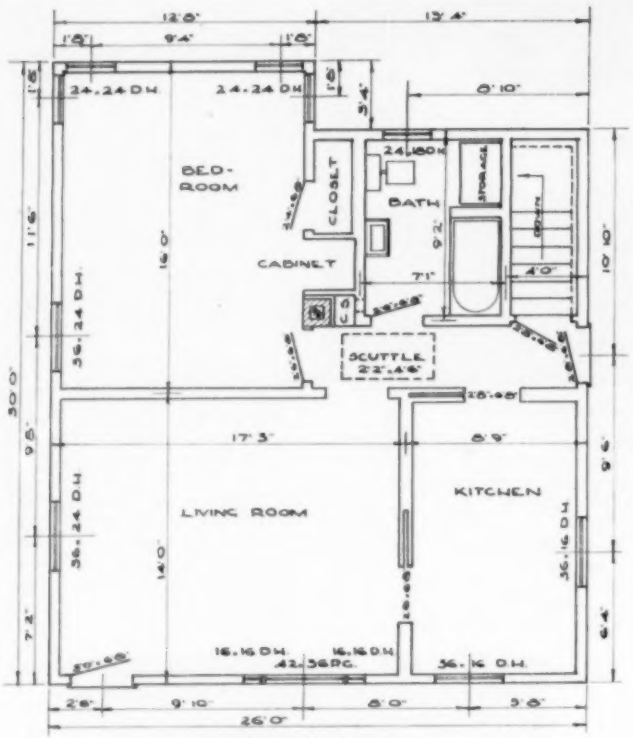


Fig. 3 — wall framing



Plan of the home

area of 776 sq. ft. As can be seen from the floor plan, each room is considerably larger than in the average small home. It has been planned with a view to adding another bedroom and a vestibule at a future time. It will preferably face either South or West. Some of the desirable features are a large kitchen with ample cupboard and storage space, a linen cabinet in the bathroom, clothes chute from the bathroom, and a built-in cabinet with trays and shelves in the bedroom. The plan shows a sliding door between the kitchen and living-dining room, and also a collapsible stair to the attic storage space. The doors and windows are to be weather-stripped, and reflective insulation, to act also as a vapor barrier, will be used in walls and ceiling.

Actual construction on the house began in the early part of April, at the beginning of the spring quarter, when stakes and batter boards were set, and forms built for temporary piers. Sills, floor joists, subfloor and walls were constructed during this quarter. The summer session class finished the diagonal sheathing, placed the ceiling joists, framed the roof, and constructed the cornice. Shingling, siding, and insulation will be completed by students during the fall quarter. Carpentry III students will do the inside finishing.

The summer session class was made up of 17 Carpentry I and Carpentry II students. A large percentage of the students were "G.I.'s" with varied previous building experience. The men worked in teams of two, with one man chosen by the instructor as foreman. The rough carpentry operations were listed on a job analysis chart, where a permanent record was kept of actual operations performed by each student. Students drew plans and framing details to scale, with the bill of material for every part of the house. Naturally, it is not possible for each student to perform every operation in one quarter. The analysis chart, however, is a great aid to both student and instructor in showing exactly which operations have been performed.

Several departments in the industrial division at Stout are co-operating in the planning and building of the house. Architectural students have drawn plans and are making blueprints. A class in electricity will do the house wiring. The millwork is being planned in a cabinet and case design class. The sheet-metal department is planning the heating for the house.

While speed is necessarily sacrificed to give the classes of 16 students and foreman varied experiences, the job is progressing with reasonable speed. At the close of the fall quarter, 1948, the house should be completely enclosed and wired. When completed in 1949, the house is to be sold and moved to its permanent site.

THE EFFICIENT USE OF CUTTING FLUIDS

R. M. DYKE
Vancouver, B. C., Canada

(Continued from page 295 of the September, 1948, issue)

Part II — How to Use Straight Cutting Oils

In this section, cutting fluids of the straight oil type, namely, those which consist primarily of oil or oils, and are not used in emulsions with water, will be discussed.

These have many special uses in modern machine and school shops. For operations where the more common soluble oil-water mixtures, or emulsions, lack in sufficient lubricating value, the straight oil types can be used to very good advantage.

These cutting oils can now be chosen correctly with a great degree of certainty. Since many of them have been developed to meet definite conditions, an appreciation of the basic principles involved is essential, if the highest efficiency and economy from these oils is to be attained in machining operations.

Although the term *cutting oil* is frequently used in a very general sense, it will here be employed to designate only the straight oil type or waterless cutting fluids. Cutting oils provide lubrication as their main function, for the heavier cuts at slower speeds, on the hard high carbon and alloy steels. They are also used for operations like threading, tapping, broaching, and hobbing. Soluble oils, however, are noted mainly for their cooling ability.

To obtain sufficient cooling with the straight cutting oils in severe service, it should be kept in mind to supply the oil in sufficient volume. This factor is too often neglected in their application.

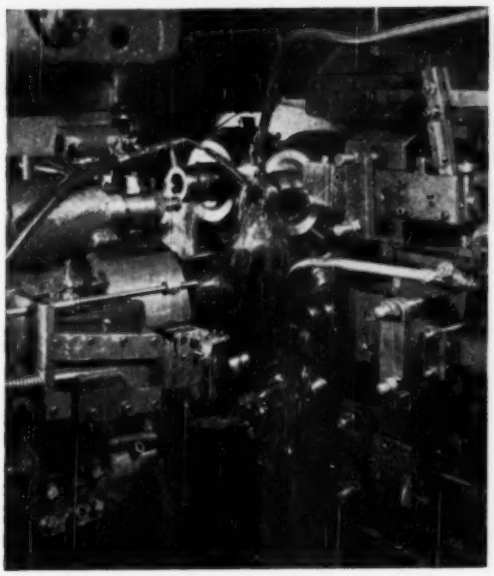
What a Cutting Oil Is

The most common type of modern cutting oil consists of mineral oil, plus a fatty oil such as lard oil, and contains one or more additives such as sulphur and chlorine, to impart special properties. A synthetic fatty oil is commonly used instead of the animal oil, although the resulting compound may still retain the name of *mineral-lard oil*.

Straight Cutting Oil Types

In addition to the usual kind mentioned in the foregoing, a variety of other cutting oils are available. Straight lard oil, which has been used for heavy duty operations and on hard steels, also for tapping and threading, is seldom used now, due to its prohibitive cost. It also becomes rancid and odorous in use, encourages development of bacteria and tends to promote gumming of machine parts and supply system. The term *lard oil* is still used at times to denote cutting oils in general.

Mineral-lard oils, which have from 10 to 40 per cent lard or synthetic fatty oil added to the mineral oil (of medium viscosity), are also used without the special additives, for general machine work. The percentage of fatty oil may be varied, in the oils purchased to suit the hardness of the steel or severity of operation.



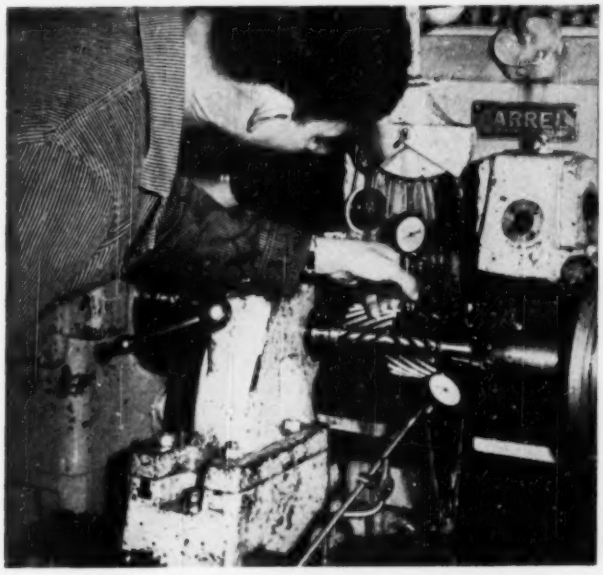


Fig. 1. Machining done on an automatic lathe requires a large flow of cutting oil supplied by a number of nozzles
Fig. 2. Transparent cutting oil supplied by special adjustable nozzles makes this gear-cutting operation much easier

Sulphurized cutting oils are superior to the types mentioned, for heavy operations on steels and for most work on tough alloy steels, nickel alloys, stainless steels, and thread cutting. They also are good for general use on all steels, and are now widely used. Sulphurized oils must contain active sulphur, as inert sulphur gives no advantage.

The sulphur imparts good antiweld properties to the oil, preventing chips from welding to the tool point and resulting in a rough finish. See Figure 3. These oils also give superior cooling and good visibility. Straight mineral oils, also the mineral-fatty oil types, are treated with up to 3 per cent of active sulphur.

Drawbacks with these oils are that they tend to turn brass and other copper-base alloys black, unless the oil has been specially treated.

Plain mineral oil, and of low viscosities, is confined to light operations, especially on nonferrous metals, and in automatics, where soluble oil or the additives of other cutting fluids may enter and affect the machine bearings.

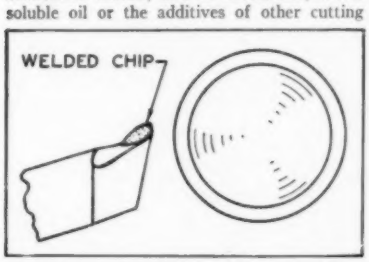


Fig. 3. The correct use of cutting oil will prevent the welding of chips to the cutting edge

Cutting oils with a high E.P. (extreme pressure) factor, contain proprietary additives, such as specially treated fats and waxes, for operations involving high heat and pressure, and may contain sulphur in addition.

Base cutting oils, of concentrated form, are popular in some shops. They are blended with cheaper mineral oils of desired viscosity and to desired additive content, to suit the severity of the operation. These oils may be plain or sulphurized. Commercial cutting oils are available in viscosities of about 75 to 1200 seconds at 100 deg. F., the heavier grades being intended mostly for dilution.

Straight Cutting-Oil Selection Chart

Type of Straight Cutting Oil	*Applications*
Mineral-lard oils	For general machining of carbon and low alloy steels. Copper, brass, bronze, and automatic screw machine use.
Sulphurized mineral-lard oils	High alloy steels, nickel alloys (Monel), stainless steels. General tapping, threading, broaching.
Straight mineral oils	For brass, bronze, automatic screw machine use and for blending purposes.
Grinding oils	External and internal thread grinding, general internal grinding.
E.P. (extreme pressure) oils	For severe applications of extreme heat and pressure.
Transparent cutting oils	Where visibility is important. Heavy and light-duty grades, with and without sulphur, available.

Fig. 4. Straight cutting-oil selection chart

The most efficient viscosity is best determined by trial, being increased, up to a certain point, with increase in heat developed, with material hardness, depth of cut and with decreased cutting speed. Smoking denotes too heavy an oil (high viscosity), or insufficient volume. A viscosity of 200 seconds at 100 deg. F. is generally suitable for straight mineral cutting oils.

Special grinding oils are now also available, designed to replace soluble oil-water emulsions which have been used heretofore. Transparent cutting oils, an additional group, offer obvious advantages for many applications. See the Table in Figure 4 for a guide to oil selection. In special cases, the cutting oil manufacturer should be consulted for the best choice.

How to Apply

When the machine is equipped with the usual pump and circulating system, the oil must be turned on with sufficient pressure and volume. Correct nozzles must also be employed, as indicated by the various illustrations. Oil may also be forced to the tool point through the tool itself, such as a drill or boring bar, which aids in ejecting the chips at the same time. See Figure 5.

For short runs and smaller volumes of oil, the methods shown in Figures 6 and 7 may be used to good advantage.

Making Cutting Oils Last Longer

To prolong the life of oil used in the system of a machine, it must be purified from time

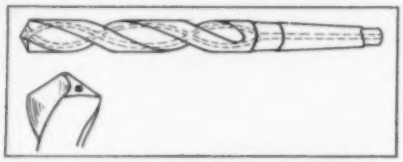


Fig. 5. Special method of supplying lubricant through the cutting tool

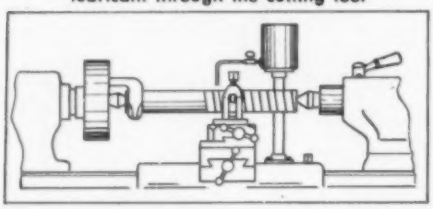


Fig. 6. Tank attached to lathe carriage to lubricate cutting tool

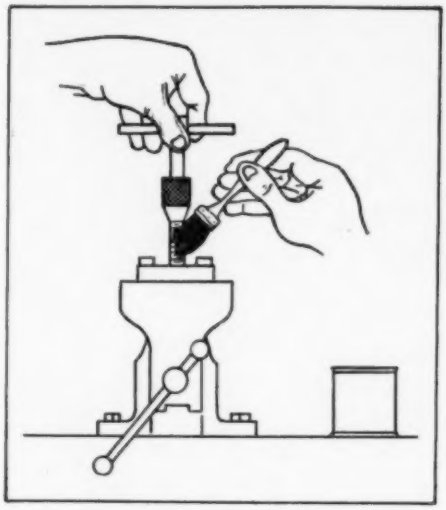


Fig. 7. At the right is shown a convenient method of applying cutting oil for hand and machine operations where small amounts only are required

to time, or changed at regular intervals. Purifiers and filters are available for this, and may also be installed on the machine itself.

Chips separated by screens and taken from the machine or settling tank, can be further processed to recover oil adhering to them. Chip wringers or settling tanks are employed for the larger chips. Centrifugal chip extractors are also on the market. These will remove the smaller chips not easily separated by screens. Heat can also be used to speed up the process of separation.

These methods result in considerable savings where much oil is used. Oil contaminated by bacteria can be resterilized, by heating it about 35 degrees above the boiling point of water, and higher in some cases.

Avoid Skin Troubles

Bacteria in cutting fluids usually originate from outside sources, as most of these fluids are sterile when bought, and contain an added germicide. Avoid skin troubles or dermatitis, as follows:

1. Keep oil free from outside contamination. Do not allow the system to become contaminated: No refuse, saliva, or food crumbs should enter the chip pans or oil reservoir of the machine, to encourage bacterial growth.

2. Do not neglect small skin cuts and abrasions, and do not wipe hands with oily rags containing many small chips.

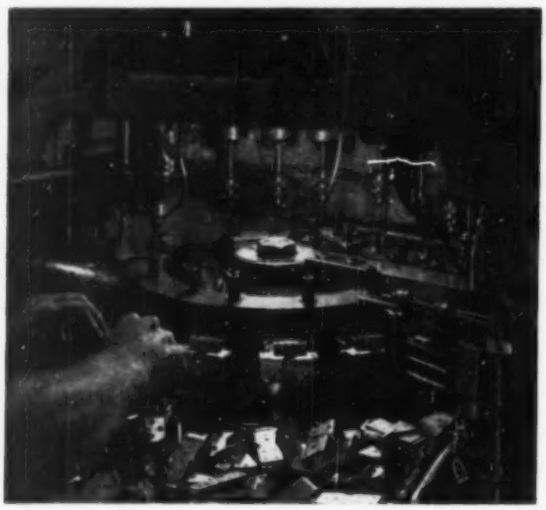
3. Cleanliness of body and clothes is very important.

4. Operators with tendencies toward skin troubles or with dry skin should apply protective cream, available for this purpose.

Additional Points

Soluble oil may be distinguished from cutting or from lubricating oil by stirring a small amount into water, which then turns milky. The best method of keeping all oils identified

(Continued on page 14A)



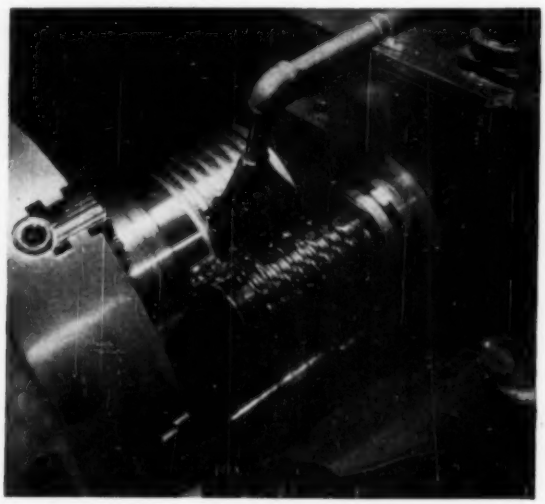


Fig. 8. Providing cutting oil for tapping operations. Fig.9. This thread milling job requires a cutting oil containing both sulphur and lard oil

Note: School orders get special attention in our delivery schedule!

DELTA MILWAUKEE®

A DELTA saw that takes 13 3/8" of wood under the upper guide!

...and cuts aluminum, too

$325.00 without motor or switch
Price subject to change without notice

Extra-safe for students!

DELTA® 20" BAND SAW

Practical features like these have been built into this big Delta 20" Band Saw, to help the student do better work — and do it more safely:

Ball-bearing blade guides — adjustable with micrometer accuracy — reduce blade breakage.

Welded steel cabinet — a single unit — protects student from working parts.

Blade above table is guarded right to point of cutting.

Statically-balanced wheels run on lubricated-for-life ball bearings.

Aluminum wheels reduce flywheel action after motor is shut off.

Foot brake on lower wheel enables student to bring machine to a quick stop (after power is shut off) before leaving machine.

Switch can be padlocked, to prevent unauthorized use.

Your nearby Delta distributor would like to show you the Delta 20" Band Saw. See it on his sales-floor soon. Or, send coupon for free Catalog A-48.

(Saw also available through Crescent Division distributors.)

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ROCKWELL MANUFACTURING COMPANY
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(Time payments can be arranged. See your Delta Dealer.)

Look for the name of your Delta distributor under "Tools" in the classified section of your telephone directory.

B-39A

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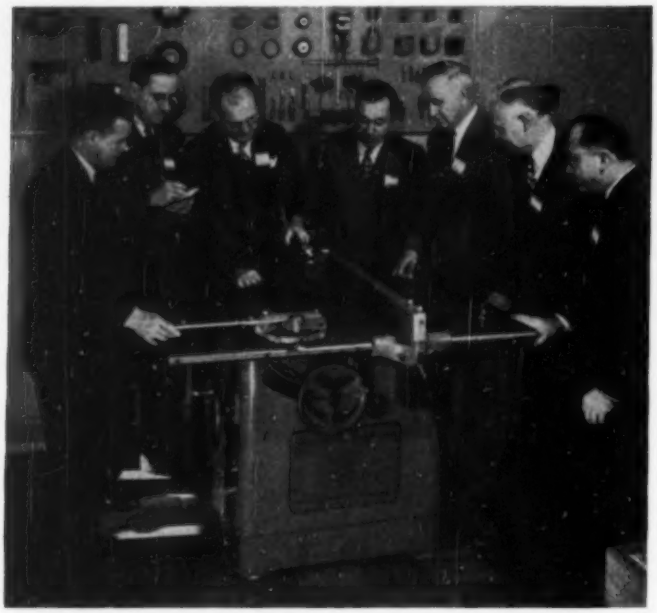
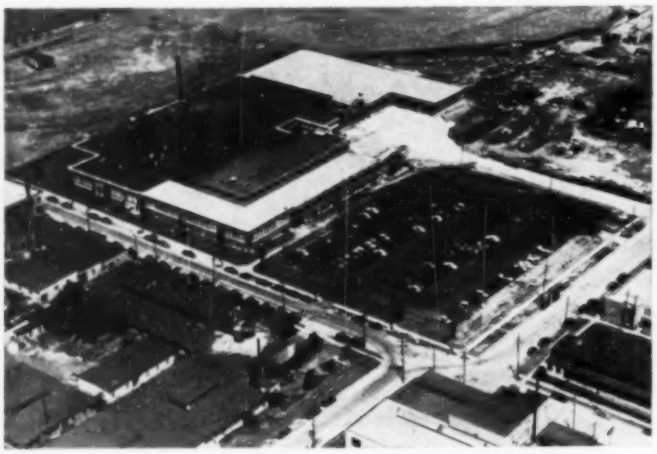


Included in the industrial-arts tours conducted during the A.V.A. convention in Milwaukee was a trip through the plant of Delta Manufacturing Division. Among the 225 shop teachers and supervisors taking the tours were these men shown inspecting the new Delta 12-in. Tilting-Arbor Saw: O. W. Connett, Peoria, Ill.; DeWitt Hunt, Stillwater, Okla.; G. Wesley Ketcham, Hartford, Conn.; Roy Radtke, Milwaukee, Wis.; C. E. Nihart, Los Angeles, Calif.; Roy G. Fales, Albany, N. Y., and Ivan Hostetler, Raleigh, N. C.



Plant of the Delta Manufacturing Division of Rockwell Manufacturing Company

CUTTING FLUIDS

(Continued from page 80)

is to use a color code for the various cutting fluids as well as lubricants used in the shop. Everything from small squirt cans to oil drums should be given dabs or bands of the identifying paint, and posters used to explain the color code.

Cutting oils are not always readily distinguishable from lubricating oils, and this must be watched, as some additives used in the former can do harm if inadvertently used in the gear case of a machine tool. Doubtful samples may be compared with each of the *lube* oils used in the shop, by the specific gravity, viscosity, color, etc. If doubt then still exists, the oil should be set aside for a detailed analysis, if possible, or used for other purposes than machine lubrication.

Cutting oils of different types should not be mixed in use, since the special additives involved may not be alike.

Far from being simply an aid in machining, cutting fluids are indispensable for efficient work, and will solve many tough machining problems, in metalworking plant and school shop alike.

AN ADDITION

Since the article entitled "Related Training for Veterans in On-Job Training Programs," pages 13–15, January, 1949, issue, was prepared, some changes have taken place in the administration of the various acts dealing with training of veterans. The Veterans Administration, because of budgetary cuts, has been unable to carry out as extensive a supervisory program with nondisabled veterans as was contemplated after the passage of Public Law 679. However, if the best interests of the very large group of nondisabled veterans are to be served it still remains that the Veterans Administration representatives ought to attempt to carry out the responsibilities outlined in the article.

It should be added that many veterans are not now receiving related training or have not taken advantage of training opportunities offered them under federal legislation. It would serve no good purpose to attempt to place the blame on any one individual or organization for this situation, but it should be emphasized that for many veterans it is still not too late to enter upon some form of on-job training. Every effort should be made, therefore, to continue this very worth-while educational program.

Personal News

RALPH T. CRAIGO RETIRES

Ralph T. Craigo was retired October 1, 1948, as assistant director of the William Hood Dunwoody Institute, Minneapolis, Minn. He entered employment with Dunwoody in December, 1914, and has been continuously employed by Dunwoody for the past 34 years.

Mr. Craigo has taught special courses at the University of Minnesota, Colorado State College, and other institutions which conduct professional training for teachers of industrial subjects. He has produced many articles which have been published in educational journals, and coauthored a book on mathematics.

Mr. Craigo plans to visit high schools throughout the upper Midwest as a consultant in industrial education.

(Continued on page 16A)

You've never seen such a mimeograph

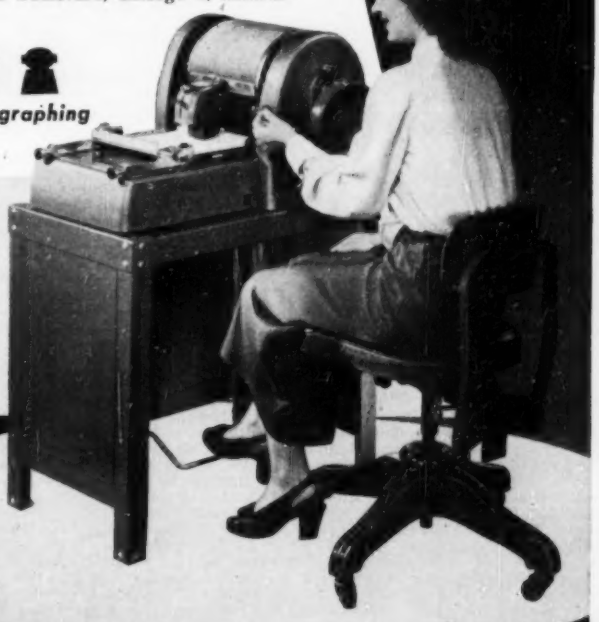
Here, for the first time, is a table-top mimeograph with a self-contained electric-drive. The operator remains comfortably seated while this machine produces clear, sharp copies of written, typed and drawn material at the rate of 140 per minute.

Designed to answer the increasing requirement in schools for more and more copies of a greater variety of forms, lesson sheets, bulletins and similar material.

Investigate this new A. B. Dick mimeograph, model 435. For use with all makes of suitable stencil duplicating products. Look in the phone book or write for the name of your nearby A. B. Dick Company representative. A. B. Dick Company, 720 West Jackson Boulevard, Chicago 6, Illinois.

A. B. DICK

—the first name in mimeographing



and now the mimeograph operator sits down too →

Shown at right is the model 27 A. B. Dick mimeograph stand with built-in foot control for fast fatigue-free operation.

Get your copy of the new Starrett Precision Tools Catalog "A." It's a gold mine of information and a complete catalog of the newest and best tools for automotive, aviation, machine and farm equipment maintenance . . . with a complete section that shows the fastest and most profitable ways to use them for better servicing.

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(Continued from page 14A)

NEW CONTACT MAN FOR REHABS

Stanley Willson has replaced Oscar Cornelius as contact man for all rehabs enrolled in below college level schools in St. Paul, Minn. Those at Dunwoody Institute also come under his jurisdiction.

Mr. Cornelius has gone to on-the-job training, the position which Mr. Willson formerly held.

Rehabs with training problems can call Mr. Willson at his office.

♦ PHILIP RUEHL, after receiving his M.S. degree at the end of the 1948 summer session at The Stout Institute, Menomonie, Wis., was urged to remain at Stout as instructor of electricity. He and his wife and three children are now living in Menomonie.

♦ W. BEN. HUNT of Hales Corners, Wis., was presented with the Silver Beaver Award at the annual meeting of the Milwaukee County Boy Scout Council at the Public Service Building Auditorium, Milwaukee, Wis., on November 23, 1948.

Mr. Hunt is field commissioner in handicraft for the Milwaukee Scout Council and a member of the editorial staff of *Boys' Life* magazine.

♦ MERLE O. WIENER has joined the teaching staff at Iowa State College, Ames, Iowa.

He received his B.A. degree from Iowa State Teachers College in Cedar Falls. He took graduate work at Ohio State University, and is completing work on a master's degree at Iowa State College.

Mr. Wiener taught at Greenfield and Red Oak for four years before entering the navy. He held an aviation metalsmith's rate and served as an instructor and supervisor of sheet-metal instruction for three and a half years. The past two and a half years he taught in the Dubuque High School. His major teaching fields are sheet metal, bench metal, and woodworking.

♦ THOMAS B. MOULE, formerly assistant director of sales, has been appointed sales manager of the Plomb Tool Co., Los Angeles, Calif. Since joining the company in 1944, Mr. Moule has supervised various important sales and merchandising activities. He is a graduate of the University of Michigan, and has had advertising and sales promotion experience with the Ex-Cello Corp., Detroit machine tool builders, with R. L. Wolfe & Associates, Detroit advertising agency, and with the Northern Aircraft Products Division of The Aviation Corporation.

♦ R. R. REED is now teaching day trade auto mechanics in Salina High School, Salina, Kans.

♦ CLYDE G. WINTER, industrial-arts instructor in the high school at Great Bend, Kans., has been appointed director of the evening adult education program.

♦ DR. CLAUDE E. RHOAD has been named head of the University of Nebraska vocational education department. He succeeds Dr. Harry E. Bradford, head of the department since 1919, who retires February 1, 1949.

Dr. Rhoad has been on the vocational education faculty of Ohio State University since 1937.

♦ C. F. KLINEFELTER, a veteran member of the staff of the Office of Education's Division of Vocational Education, has been designated as consultant, supervisory training in industry. For 16 years Dr. Klinefelter was associated with the late Charles R. Allen in the training of conference leaders for the vocational education program and in the development of instructional material for use by foreman conference leaders. Dr. Klinefelter will serve on the staff of the Trade and Industrial Education Service, Office of Education.

♦ S. D. MULLIKIN, superintendent of the Ford Trade School, spent three days in Chicago attending the National Safety Congress. He was chairman of the National Safety Council Joint Committee on Safety Education.

♦ DANIEL J. PAOLUCCI of Buffalo, N. Y., has accepted the position as instructor in the general shop of the Oswego State Teachers College. Mr. Paolucci was graduated from the Buffalo State Teachers College in 1938, and is doing summer graduate work at Cornell University.

Mr. Paolucci taught for ten years in the Endicott School System, Endicott, N. Y., before going with the educational departments of the Sperry Gyroscope Co., and International Business Machines Corporation. He then worked in various capacities with the military educational system of the Warton Technical School of Warton, England, the Friscan Technical School for the 3rd Army at Eschwege, Germany, and the Heidelberg Consolidated Command School of the Heidelberg Military Post.

♦ WILLIAM F. TIERNEY has been appointed instructor in the transportation area of the division of industrial arts at the Oswego State Teachers College at Oswego, N. Y. Mr. Tierney, former head of the industrial-arts department of Thonaston High School, Thonaston, Conn., received his B.S. at the Teachers College of Connecticut, New Britain, Conn., and did his graduate work at the Ohio State University, Columbus, Ohio. Previous to his service in the army, Mr. Tierney was head of an exemplary laboratory at the Ray-Technical High School in Modus, Conn.

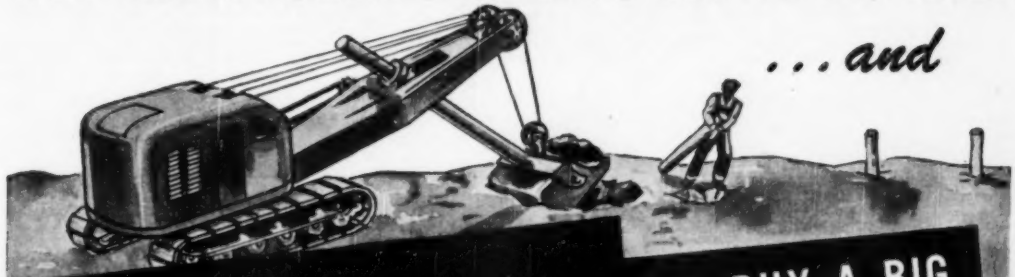
♦ A. G. CLEAVER, formerly teacher of drafting at Central High School, Fort Wayne, Ind., has joined the teaching staff of the local Purdue Extension Center.

♦ HAROLD NELSON has been appointed general shop instructor at the Junior High School, Fort Wayne, Ind.

♦ DR. JOHN LEE has recently been elected president of the National Society for Crippled Children, the organization which sponsors the Christmas Seal.

♦ ROLAND FRASER is developing a course in general metal which will include silversmithing and metal spinning at Wayne University, Detroit, Mich.

WHY USE A POWER SHOVEL TO DIG A POST HOLE



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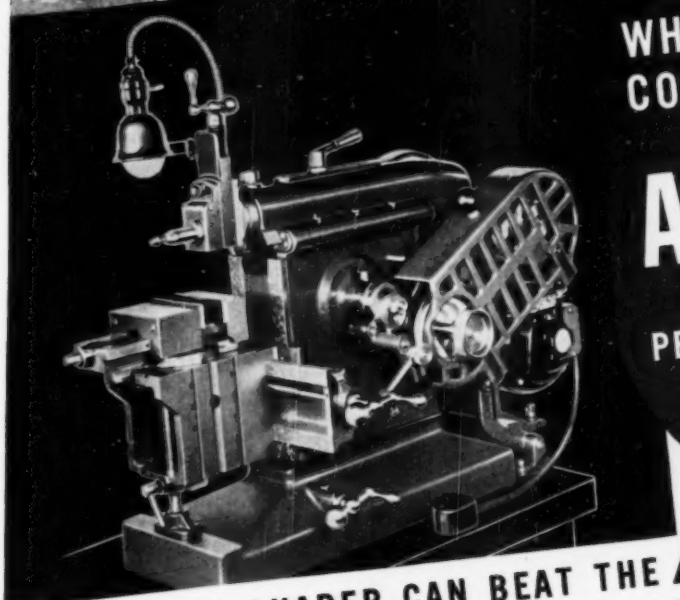

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NO BIG SHAPER CAN BEAT THE AMMCO FOR *ACCURACY ☆ VERSATILITY ☆ SPEED ☆ ECONOMY*

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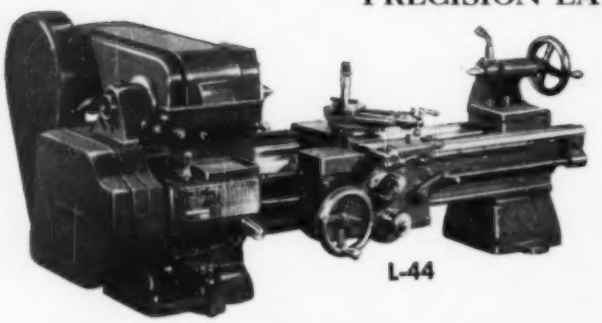
PRECISION LATHES



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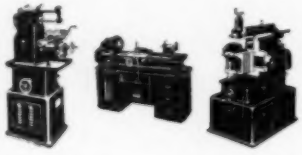
If Handicapped for Space or Funds, this smaller *SHELDON* will give *MAXIMUM* shop capacity

If you are faced by space limitations or size of appropriation, you can still give a practical course in lathe operation. Smaller, less expensive, the Sheldon L-44 lathes are of standard industrial type, capacity, and precision.

They have 10⅛" swing, ¾" collet capacity, large industrial type Timken Taper Roller Bearing, and a sturdy 44" bed that is held to .0005" tolerances of parallel and longitudinal alignment. They have standard industrial controls, full quick change gears and a completely enclosed motor drive — yet cost only $472.00.

Write for Sheldon Machine Tool and Accessory Catalog or send 75¢ for Sheldon's simplified beginners text, "Care and Operation of the Lathes."



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Association News

A.V.A. CONVENTION AT MILWAUKEE

The 42nd Annual Vocational Convention, held at Milwaukee, Wis., November 30 to December 4, 1948, was a great success in every way.

There were more members in attendance, the commercial exhibits were in greater numbers, and the Milwaukee Auditorium Hall permitted the exhibits to be more effectively displayed than ever before.

The educational exhibits of vocational programs, arranged by the vocational schools of Wisconsin, were outstanding and received much commendation. They displayed the philosophy of the Wisconsin system of vocational and adult education, and showed the economical system under which it operates independently of the general system of education. In 26 years of operation these schools have spent $58,806,152 although legally $78,325,437 was available under the established millage tax.

Numerous trips had been arranged for visits to industrial plants, places of business, schools, and for sightseeing so that the desires of the visitors and wives could be fully satisfied.

At the opening session on November 30, at 8:00 p.m., Hon. Frank B. Keefe, member of Congress from Wisconsin, pleaded with the members of the American Vocational Association, to try to do their best with the reduced funds which they could expect from Washington for the coming year. Foreign aid, the cost for keeping our armed forces even partially equipped for all eventualities, all required such huge sums of money that education and other necessary expenditures had to be curtailed.

A panel discussion was held, the members of which presented their experience abroad, in Korea, Germany, South America, Canal Zone, Austria, Greece, and Japan. From the statements given by educators, it may be plainly seen that America is confronted with a huge task of giving aid, rehabilitating industry, and building up the educational system if the countries mentioned in the foregoing are not to fall under the attempts which Russia is making to spread its ideologies in all of the war devastated countries.

Among those making reports were Dr. Verne C. Fryklund, Dr. Franklin J. Keller, Jack L. Anderson, Ralph C. Wenrich, S. L. Coover, and Edna P. Amidon.

On Wednesday evening the general session was held at the Milwaukee Vocational School, the main auditorium of which was dedicated in a special way to honor the late Dr. Robert L. Cooley who was the founder and the first director of the school.

Julian A. McPhee, president of the American Vocational Association, presided. Dr. William F. Rasche, present director of the school, introduced some of Dr. Cooley's contemporaries, and Milton C. Potter, superintendent emeritus of the Milwaukee public schools, gave the main address.

Bruno L. Blochowiak, president of the Milwaukee Board of Vocational Education, presented the dedicatory statement.

Kenneth McFarland, superintendent of schools, Topeka, Kans., gave a rapid-firing, thought-inspiring talk on education in general.

The annual banquet was held on Thursday evening. The attendance at this affair ran up to the unprecedented number of 1100. President Julian A. McPhee presided, and Russell K. Britton was the toastmaster.

A number of life memberships were announced by L. H. Dennis, executive secretary.

Since there were no addresses, the A.V.A. dance slated for 10:00 p.m. to midnight, could be started quite promptly.

INDUSTRIAL-ARTS SECTIONAL MEETINGS

The first of these was held Tuesday morning, November 30, 1948. The subject of discussion was "The Role of State Supervisors in the Developing Pattern of Local, State and National Industrial Arts Programs." John Ludington, specialist in industrial arts, U. S. Office of Education, Washington, D. C., was chairman. He led the lively discussion which centered about the possibility of formulating the proper industrial-arts program for schools in different types of communities; the objections encountered in trying to formulate a unified national program; and the question as to how industrial arts can be changed to meet life adjustment education.

At the Tuesday afternoon session Roy G. Fales, state supervisor of industrial arts, State Education Department, Albany, N. Y., acted as chairman.

At this meeting "The Function of the State Supervisors in Relation to a State Program of Industrial Arts" was discussed. Topics touched upon were: The relationship of the state supervisor to teacher training; to the teaching of shop subjects in cities, small school districts, and country schools; his responsibilities to curriculum training, and course of study preparation, and broad promotional programs.

(To be continued)

♦ The thirty-third annual Professional Conference for Directors, Supervisors, Principals, and Department Heads in Vocational and Practical Arts Education was held at the Lake Placid Club, October 10 through 14.

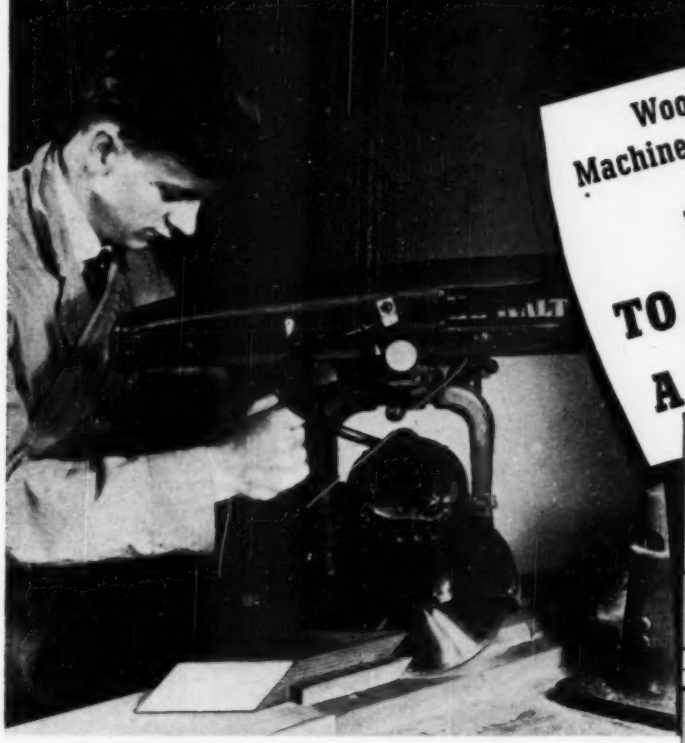
Dr. R. W. Gregory, assistant commissioner of education for the U. S. Office of Education, provided an appropriate beginning for the conference when he addressed the group on "Accomplishments and Issues in Vocational Education."

Dr. Gregory said, in part:

". . . Since the passage of the Smith-Hughes

(Continued on page 20A)

Make this a required course . . . and your wood-shop training is complete!



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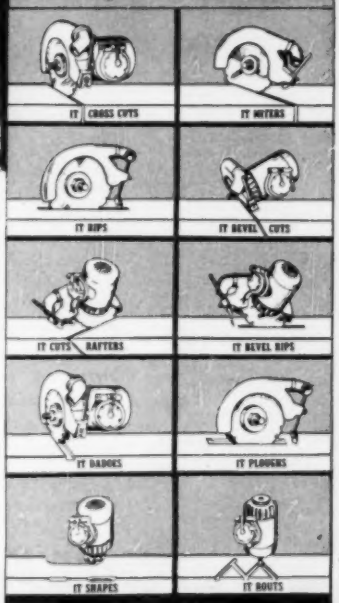

. . . and with proper tools makes any cut possible!

After the student has completed his basic training course in the use of hand tools, he should have a required course in the operation of DeWalt.

Knowing how to make the fullest use of this flexible, easy-to-operate machine, will give any student a head-start as he prepares for tomorrow's industry.

When he leaves school he will be fully acquainted with a machine that is destined to occupy a prominent place in tomorrow's industry. The perfection of the DeWalt saw has created new methods in cutting wood, making obsolete old-style equipment previously used.

Ask a nearby DeWalt dealer about two DeWalt 16MM movies—one showing the general application of DeWalt—the other showing modern, pre-cutting techniques developed during the war. Write for catalog.

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The way industry does it

in grinding and finishing metal is by the belt-backstand method — fast becoming universal practice for more and more operations. Behr-Manning METALITE* Cloth Belts, fast, cool-cutting, enduring, have been a big factor in this development. Use these belts and the belt-backstand method in your teaching now.

For hand or machine sanding on wood, metal, plastics, give your students a true picture of present-day production methods with the correct Behr-Manning coated abrasive disc, sheet or belt. Show him how these modern abrasives are cutting costs in industrial output everywhere. Ask your distributor, or write for catalog. Also complete educational program of teaching aids on request.

* *Reg. U. S. Pat. Off.*

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NORTON *abrasives*

QUALITY COATED ABRASIVES FOR 76 YEARS

(Continued from page 18A)

Act by Congress in 1917 and largely due to the stimulus it affords, approximately half of the secondary schools now provide education in one or more occupational fields in which there were 2,508,618 enrolled in the year ending June 30, 1947. Almost $100,000,000 was expended for salaries alone in connection with this program that year. During the past 30 years tens of thousands of teachers and supervisors have been given excellent teacher education for the job they are to do. All of the time local boards of education have consistently followed the practice and principle of gearing their vocational education efforts to reality by providing for and utilizing the services of thousands of laborers, farmers, homemakers, businessmen, and manufacturers on advisory committees.

"During the recent war the schools operating vocational education programs co-operated with the federal and state governments in making available training programs to more than 11 million enrollees for work in industry, on the farm, and in the home."

Franklin J. Keller, principal of the Metropolitan Vocational High School of New York City, talked on "Germany — What Can We Educators Learn From the Occupation?" The occupation is fundamentally a device for keeping the peace, both negatively and positively. However, whatever we can do, to bring about a better world, we are morally obliged to do.

The president of the New York State Federation of Labor, Thomas A. Murray, made a plea for continued and strengthened encouragement of the principles of democracy in our vocational schools.

On Monday most of the day was devoted to workshop conferences. Topics covered were: "Technics and Procedures for Determining the Content and Extent of the Related or Technical Subjects in Industrial High Schools"; "Curriculum and Course Planning for Life Adjustment Education Program"; "Apprentice Training and Occupational Extension Programs"; "Establishing and Organizing the Area Vocational School in the New Intermediate School District"; "Evaluating and Extending Industrial Arts Programs in the Various Types of Secondary Schools of the State"; "1950 Goals for Business and Distributive Education."

♦ At the respective meetings of the Kansas Vocational Association and the Kansas Industrial Education Association meeting held in Topeka on November 4, 5, and 6, the following officers were elected: president, W. F. Currier, McFarland Trade School, Coffeyville, Kans.; vice-presidents representing: agriculture, Carl Heinrich, High School, Great Bend, Kans.; home economics, Miss Catharine Zink, High School, Lincoln, Kans.; business education, Milton Karstadt, co-ordinator-instructor, Coffeyville, Kans.; trade and industry, Loren M. Nuzman, Topeka High School, Topeka, Kans.; secretary-treasurer, F. E. Carpenter, Highland Park High School, Topeka, Kans. Officers for the Kansas Industrial Education Association are: president, Loren M. Nuzman, Topeka High School, Topeka, Kans.; vice-president, R. R. Reed, Washington Senior High School, Salina, Kans.; secretary-treasurer, Kenneth R. Powers, Topeka High School, Topeka, Kans.

♦ At the Washington convention of the American Industrial Arts Association held in May of 1948, St. Louis was chosen as the 1949 convention city. Headquarters will be at the Hotel Jefferson and the dates are May 19, 20, and 21.

Dr. Walter R. Williams, professor of industrial-arts education, University of Florida, is president, and DeWitt Hunt of Oklahoma A. & M. College, is vice-president.

♦ The Missouri annual spring conference on industrial education, which is sponsored jointly by the college of education of the University of Missouri and the industrial-education section of the Missouri state department of education, will meet at the University of Missouri, Columbia, Mo., Friday and Saturday, April 22 and 23, 1949.

♦ The annual state T. & I. conference was held

(Continued on page 21A)

(Continued from page 20A)

on October 8 and 9, 1948, at Topeka, Kansas. Representatives from the Bureau of Apprenticeship, Office of Veterans' Affairs, Topeka High School, and State Board for Vocational Education, were the speakers on the first day. C. E. Rakestraw, consultant, employee-employer relations, U. S. Office of Education, conducted the discussion of the part-time occupational education program.

♦ The members of I.A.T.P.A. made an inspection tour of Dravo's Ship Yard on Neville Island on November 17, 1948. After this trip they met at Neville Township High School, Pittsburgh, Pa., for a business meeting.

♦ The officers for the year 1948–49 of the Oklahoma Industrial Arts Association are: president, H. A. Allender, Tulsa; vice-president, John L. Cermak, Weatherford; secretary-treasurer, C. L. Hill, Stillwater; directors, B. H. Thomas, Oklahoma City; Myrl S. Kirk, Enid; and Asbury Smith, Edmond.

INDUSTRIAL EDUCATION CONFERENCE DATE SET

Plans are well under way for the second Industrial Education Conference, to be held at Iowa State College, Ames, Iowa, on Friday, April 15, 1949. Shop teachers, supervisors, directors, and school administrators, are all invited to attend.

♦ The annual spring conference of Industrial Arts Education will be held at New York University, Washington Square, New York, N. Y., on Thursday, Friday, and Saturday, April 28, 29, and 30, respectively.

♦ A committee of five persons met on Monday, September 27, to discuss the feasibility of establishing an Ohio council of local administrators of vocational education or practical and industrial arts. The members of the committee were supervisors or administrators of local programs of vocational education or industrial arts and represented the various sections of the state. The committee met in the State Office building in Columbus, Ohio.

At the close of the trades and industries workshop, held at Ohio State during the past summer, the need for an organization of supervisors or administrators of trades and industries programs at the local level was discussed. The foregoing committee was set up to investigate the need for such an organization. The committee was also instructed to investigate the possibility of including supervisors or administrators from other areas of vocational education and from the field of industrial arts.

The work of the council shall be the consideration of all matters pertaining to the development and progress of vocational education and practical or industrial arts. It is proposed that the membership be opened to any person affiliated with the Ohio Vocational Association or the Ohio Industrial Arts Association whose major responsibility is the administration or supervision of vocational education or practical and industrial arts in a city, county, joint, or other local unit; or to persons engaged in training such personnel.

The constitution for the council was prepared by the committee and will be presented to the sectional meetings of the trades and industries groups and to the membership of the Ohio Industrial Arts Association. If a council is formed the membership will consider affiliation with the National Council of Local Administrators of Vocational Education and Practical Arts.

The membership of the committee was made up of the following persons: William Dunton, Piqua, Ohio; Ted Dietsch, Hamilton, F. D. Saine, Alliance; Eric Shattuck, Ironton; B. R. Shoemaker, Findlay. Dewey F. Barich, from Kent State University, represented the Ohio Industrial Arts Association at the committee meeting.

♦ The Department of Industrial Education at The Pennsylvania State College held its first annual conference on industrial arts and vocational industrial education on Saturday, October 30, 1948. The conference was well attended. In addition to local directors of vocational education,

(Continued on next page)

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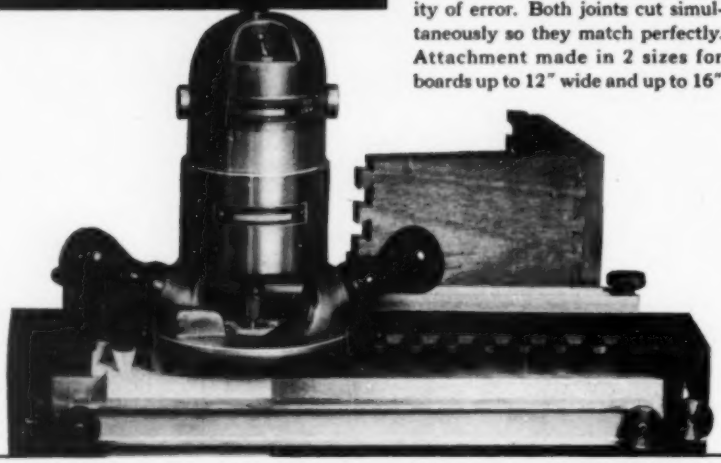

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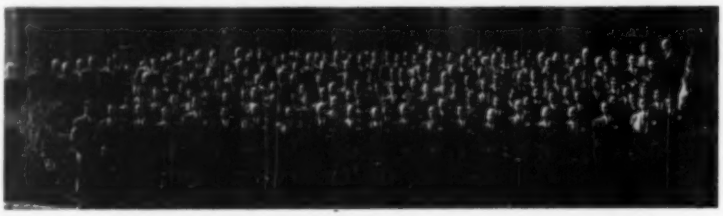

Pennsylvania State College conference of industrial arts and vocational education

(Continued from previous page)

co-ordinators, vocational shop instructors, related subjects instructors, and industrial-arts instructors, there were present good delegations representing district superintendents of schools, county superintendents of schools, supervising principals, and high school principals.

The conference opened at 10 a. m. with a general session lasting for one hour. Jesse Rees, director of vocational education in Harrisburg, Pa., served as chairman of the general session. Eugene S. Teter, county superintendent of schools, Luzerne county, addressed the general session on "What the School Administrator Expects of Industrial Arts." C. V. Erdley, district superintendent of schools in Lewiston, addressed the general session on "What the School Administrator Expects of Vocational Industrial Education."

From 11 a.m. to 12:30 p.m. two sectional meetings were conducted, one on industrial-arts education and one on vocational industrial education.

J. G. Dixon, supervisor of industrial arts in Wilkes-Barre, Pa., served as chairman of the industrial-arts sectional meeting. Three staff members of the department of industrial education addressed this group. Ralph O. Gallington, professor of industrial-arts education, spoke on "Improving Shop Layouts in Industrial Arts Programs"; Clair F. Fitz, assistant professor of industrial education, chose for his subject "A New Look at Industrial Arts"; and John F. Friese, professor of industrial-arts education, presented "Distinctions Between Junior and Senior High School Industrial Arts."

George H. Parkes, director of the Williamsport Technical Institute, served as chairman of the Vocational Industrial Sectional meeting. Three staff members addressed the Vocational Industrial Sectional Meeting as follows: "Establishing and Maintaining Relationships With Management and Labor," S. Lewis Land, director of Vocational Teacher Education; "Improving Related Subjects Instruction," Urwin Rowntree, professor of Industrial Education; and "Evaluating Vocational Industrial Programs," Robert Knoebel, part-time instructor at the College and director of Vocational Education in Sunbury, Pa.

A luncheon session which concluded the conference was held at 12:30 p.m. in the Banquet Room of the State College Hotel. At the luncheon session summary reports on the two sectional meetings held in the morning were presented. William Brown, an industrial-arts instructor in Forty Fort, presented a summary of the industrial-arts sectional meeting. William Gibbons, director of Vocational Education, Altoona, presented a summary of the Vocational Industrial Sectional Meeting. In the discussion which concluded the luncheon session, the College was urged to consider making the conference an annual event and allocating more time to future conferences.

LET'S PUBLICIZE OUR WORK*

Many shop teachers feel that they should do something to publicize their work but are at a loss to know just what to do. Below are a number of suggestions, some of which we believe can be used in every school and community.

1. *Good shop teaching* — There is nothing that will publicize industrial arts more in a community than to have on the job well-qualified, interested, and enthusiastic teachers. Poor housekeeping, poor relations between teacher and pupils, and insufficient shop safety instructions can tear down almost any attempt at publicity.

2. *Make use of local newspapers and school paper* — Most newspapers realize the news value of school affairs; items about school matters do not have to be sensational to be news. It should be remembered, however, that the primary purpose of newspaper publicity is not advertising, but it is to promote a better public understanding of the purposes and values of industrial-arts courses.

(Continued on page 25A)

*The following article was taken out of "Shop Shavings," the official news letter of the Industrial Education Club, Iowa State College, Ames, Iowa.

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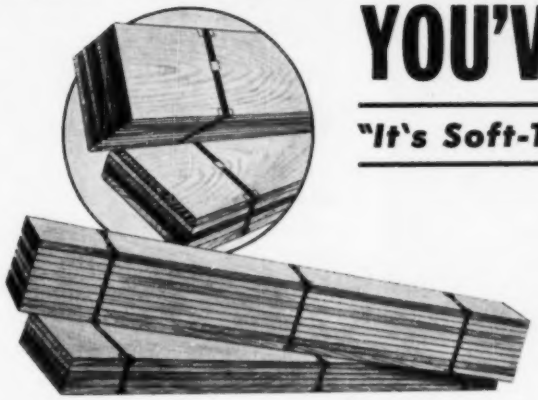

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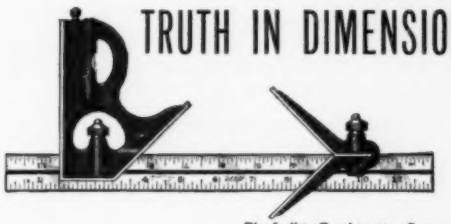

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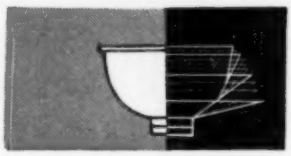

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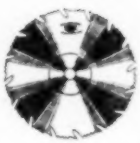

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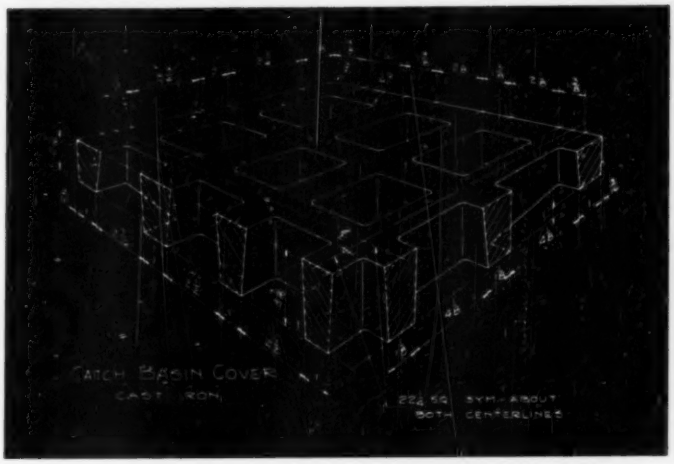

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(Continued from page 22A)

3. *Public addresses* — Many opportunities arise for shop teachers to speak before social and civic groups. We should not hesitate to tell others of our work and what its place is in the education of youth.

4. *Promote adult classes* — This provides a means of getting parents and people of the community into our shops, which if handled properly may be a wonderful publicizing device.

5. *Open house* — The shop should be open at all times to visitors. Periodically an invitation should be extended to the community to visit at a specific time.

6. Displays which will be seen by pupils and public.

7. *Organize "Home Workshop Club"* — Assist members to set up home workshops, make plans, buy tools, and even how to use tools.

8. Co-operate with local organizations.

9. Enlist co-operation of parents with home projects.

10. Make movies or slides of work which can be shown to groups.

11. Take pictures of activities in department which can be posted.

12. Invite local leaders, industrialists, and tradesmen to talk to classes.

13. Publish departmental bulletin.

14. Promote contests.

As one can readily see there are many devices which can be used in a publicity program. No one can use all of them; there must be careful selection so as to meet each local situation.

In planning a publicity program it is well to remember that education is news today as it has never been before, and industrial arts is a vital part of that education. A long-range intelligent program of publicity and public relations is needed. It is essential that those responsible for the development of this program understand what it should seek to accomplish, what goals must be maintained, and what criteria established. Our whole program, finally, must stand firm for an honest, intelligent interpretation of the significant and desirable aspects of industrial arts.

REPAIRING BROKEN JACK PLANE BOTTOMS

H. A. ALLENDER
Woodwork Instructor
Will Rogers High School
Tulsa, Okla.

Nearly every school shop has one or two jack planes with broken bottoms. Usually the break occurs at the throat. The writer tried unsuccessfully for several years to have broken plane bottoms repaired by welding. The thing that always happened was that when the welded metal cooled, it also contracted and warped the plane bottom out of a geometric plane. This rendered the plane practically useless.

In later years the writer has met with a fair degree of success by repairing plane bottoms by the following method. Grind the broken joint to an open V so as to make room for the bonding metal. Clamp the pieces of the broken plane bottom to a flat piece of steel ½ in. thick. Be sure the parts are in line with each other. The clamping may be done with C clamps. Braze the broken joints using brass rod, small torch tip, and brazing flux. With a larger tip, and with the bottom still clamped to the steel plate, heat the entire bottom before any of it has a chance to cool off. Then bury the entire plane bottom plate and all in a box of lime. Allow several hours for cooling, then remove from the lime, and take off the clamps. The lime retards cooling. The steel plate lessens distortion, and the brazing provides a slight flexibility.

When the bottom has entirely cooled it is ready for finishing. This can best be done on a milling machine by machining off just enough metal where necessary to restore the original surfaces on the bottom and the sides of the plane bottom. If a milling machine is not available this job must be done by hand methods. The bottom can be held in an ordinary vise and filed with a file to restore the surfaces. The surfaces can be checked with a steel square for straightness and squareness.

This method has enabled the writer to return many planes to active use where otherwise they would have been thrown aside as worthless scrap.

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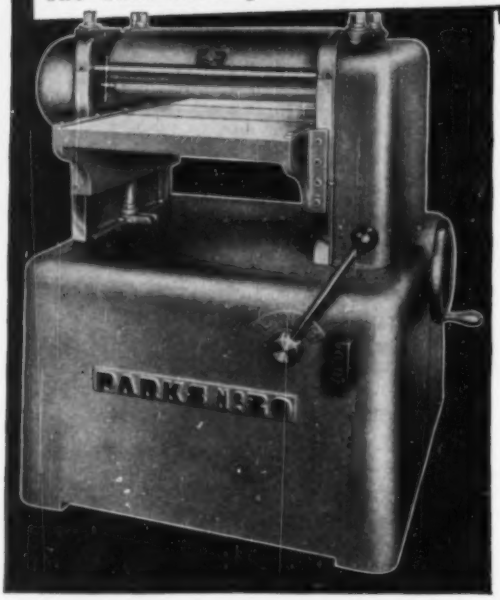

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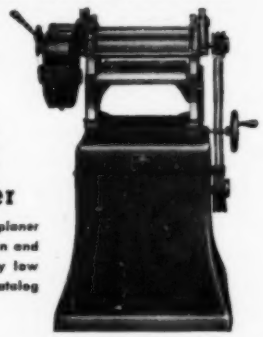

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HERE'S HOW TO STOP YOUR AUTOMOBILE SAFELY

While there are many ways to have wintertime traffic accidents, such as too much speed on a slippery curve, the Council says that stopping control would prevent many of them. Here's how to answer "Yes" to the question "Can I stop in time?"

1. Find out how slippery it is when starting out. Get this feel of the road by stepping on the brakes lightly or "gunning" the motor. But be sure you are going slow and that no other cars are near. Don't take unnecessary chances.

2. Keep your speed down. On ice, don't ever drive faster than 10 to 20 miles an hour. Speed too fast for conditions is the No. 1 winter bogeyman.

3. Use tire chains — good ones that bite into the surface. On ice and snow, tests have proved chains reduce braking distances 40 to 50 per cent. They are the best self-help you have. Council studies show that tires with abrasive particles embedded in the tread, recently placed on the market, have almost no effect on stopping on ice at low or moderate temperatures, but help some at temperatures above 23 degrees.

4. Slow down well in advance of intersections, railroads, or any situation which might require a stop. Sudden maneuvers are dangerous on slippery surfaces.

5. Follow other cars at a safe distance. And use hand signals to give the driver behind you a break.

6. Keep windshield and windows clear with good defrosters and wipers. If necessary, roll down the window a little. You can't stop in time if you can't see in time.

7. Pump the brakes when you slow or stop. The idea is to slow the wheels without locking them.

News Notes

♦ The Salt Lake Area Vocational School, Salt Lake City, Utah, was opened September 13, 1948. A large number of courses in trade and industrial, and business and distributive occupations are being offered.

♦ National Adhesives, 270 Madison Ave., New York 16, N. Y., has developed a resin adhesive that is known as Wood-Lok Q3022. It is ready-to-use as supplied, and requires no cooking, heating, or mixing. Since it sets with a noncrystalline unabrasive bond, resharpening costs of saws and downtime of machines are considerably reduced. It is very light in color and dries with a transparent glue line. Wood-Lok Q3022 is quite durable due to its resiliency after setting, and remains unaffected by most climatic variations even under strain.

♦ Ushering in the Yuletide Season in a lighter vein, Mu Sigma Pi held its last meeting of the year in the cafeteria of the Chadsey High School (Trade Division), Detroit, Mich., on the evening of December 10.

An entertaining program followed the short business meeting presided over by George W. Donaldson, Mu Sigma Pi president. It was reported to the group that the Yearbook project which is being prepared by Brother Ramsdell will be off the press and ready for distribution to Mu Sigma Pi members early in 1949.

Next on the program was an unusual travel film in color which took the group on a quick tour around the United States by bus, following the romantic interests of a young air force veteran visiting some of his old buddies from the service.

A light lunch topped off a fine evening of fellowship.

♦ To keep abreast of the times, and meet the demand for authentic servicing data for TV receivers, John F. Rider Publisher, Inc., reports the forthcoming *Rider TV Manual Volume 2*. Taking up where *Volume 1* leaves off, June, 1948, *Volume 2* offers complete coverage up to January, 1949, of TV manufacturers' data. Among those represented in the new volume will be:

Admiral	Farnsworth	Scott
Airking	Garod	Sentinel
Andrea	GE	Sightmaster
Ansley	Hallicrafters	Sonora
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(Continued on page 28A)

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These workbooks, developed by the State of Connecticut Division of Trade and Industrial Education provide problem material specifically selected for each trade. Developed for teaching mixed apprentice groups, the material is equally valuable for use in regular day and evening trade and technical programs.

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- Textiles
- Teacher Training

Write Dept. IA-29 for Examination copies or Free Descriptive Brochure.

Delmar Publishers, Inc.
Albany 1, New York

(Continued from page 26A)

Booster manufacturers too, not to be slighted, will be included. Among these are Bud, Masco, and Vision Research. Servicing data on tuners will be used in cases where they are a part of the requisite data.

TV Manual Volume 2 contains the equivalent of 2000 pages, and sells for $18.

♦ The eighth annual Science Talent Search sponsored by the educational foundation of the Westinghouse Electric Corporation is now under way. The Search is conducted by science clubs of America through science service for the purpose of discovering senior high school students with an aptitude and creative ability in science.

From a group of 40 finalists who will be brought to Washington next February for five days of final testing, the boy or girl adjudged the most promising young scientist in the nation will be awarded a four-year, $2,800 Westinghouse Grand Science Scholarship. Runners-up will receive scholarships ranging from $100 to $2,000.

♦ Pi Lambda Theta, National Association for Women in Education, announces two awards of $400 each, to be granted on or before August 15, 1949, for significant research studies in education.

An unpublished study may be submitted on any aspect of the professional problems and contributions of women, *either in education or in some other field*. Among others, studies of women's status, professional training, responsibilities and contributions to education and to society, both in this country and abroad, will be acceptable.

No study granted an award shall become the property of Pi Lambda Theta, nor shall Pi Lambda Theta in any way restrict the subsequent publication of a study for which an award is granted, except that Pi Lambda Theta shall have the privilege of inserting an introductory statement in the printed form of any study for which an award is made.

A study may be submitted by any individual, whether or not engaged at present in educational work, or by any chapter or group of members of Pi Lambda Theta.

Three copies of the final report of the completed research study shall be submitted to the Committee on Studies and Awards by June 1, 1949. Information concerning the awards and the form in which the final report shall be prepared will be furnished upon request. All inquiries should be addressed to Alice H. Hayden, University of Washington, Seattle 5, Wash., chairman.

♦ The trade and industrial division of the Kansas State Board for Vocational Education provided instruction during the past fiscal year in housekeeping and ventilation for 255 janitor-engineers employed in the schools of 86 cities, and job and safety instruction for 278 persons employed in rural electric programs in 30 localities. Traveling instructors participated in these programs.

♦ A concise outline of Department Store Work, written by Norma Squitieri and Muriel D. Lickel, has just been released by Occupational Index, Inc., New York University, New York 3, N. Y. This brief leaflet, published in October, is obtainable for 50 cents per copy, cash with order.

♦ The vocational school at St. Paul has this fall introduced an On-the-Farm Training program. To enroll in the program, the veteran must be owner, renter, or have partnership in a truck garden near St. Paul.

The instructor, Frank Gertin, a former Ramsey county agent, who also has taught agriculture in South St. Paul, drives out to the truck gardens to supervise his students. The men attend class twice a week at Ramsey school annex.

♦ On November 18, 1948, delegates and representatives of government and industry from the United States, Canada, and the United Kingdom, met at the National Bureau of Standards, Washington, D. C., and signed an accord on unifying the American and British standard systems of screw threads.

The unification agreement accepts our 60-degree flank angles, and stipulates rounded roots on external threads, and flat crests on internal threads. The number of threads per inch for the various series of thread diameters is approximately the same as our national system has them, with the exception that the ½-in. coarse thread now has 12 or 13 threads per inch. The limiting dimensions for three classes of fit also have been agreed upon.

Thus, after 30 years of effort, the interchangeability of American and British thread parts has been achieved.

♦ Issuance of "School Bus Maintenance," a guide to assist school administrators in planning and improving bus maintenance programs, was announced recently by the Office of Education, Federal Security Agency. Based on practical experience in pupil transportation, the guide outlines procedures and standards and furnishes recommendations on personnel, garage facilities, and garage equipment.

Copies of "School Bus Maintenance" (Bulletin 1948, No. 2) are on sale for 15 cents a copy by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

♦ The new industrial-arts building at Central State College, Edmond, Okla., is a modernistic concrete, steel, and glass building. It is in use since fall. The building is approximately one hundred feet square and has a woodworking shop, a general metal shop, a drafting room, a ceramics room, a classroom, and an office in addition to hallways, toilets, storerooms, etc.

The well-lighted and well-planned rooms and facilities were built at a cost of approximately $5 per square foot which is an achievement in economy.

♦ A brief but complete résumé of career possibilities in the field of medical illustration is the subject of the latest occupational abstract written by Anna L. Cohen and published in June. This leaflet is available for 50 cents, cash with

order from Occupational Index, Inc., New York University, New York 3, N. Y.

♦ The American Society for Metals has recently released a 96-page booklet titled "Your Career in the Metallurgical Profession." For a copy of this book, address American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

♦ A guide to selection of school or college education this fall is now available from the Office of Education, Federal Security Agency. Copies may be obtained by requesting Misc. 3276 from Information and Publications Service, Office of Education, Federal Security Agency, Washington 25, D. C.

♦ With all of the trade groups showing increases, the number of apprentices in the instruction industry employed on January 1 rose to 114,363.

This figure, which was compiled from 6010 reports from all parts of the country but does not represent complete coverage, is 2151 higher than the 112,212 listed on December 1.

The electrical trades, which showed a slight decline on December 1 from the November 1 total, more than made up for that loss to set a new mark of 17,368 on January 1. A breakdown of the number of apprentices employed in the other construction crafts on January 1 follows:

Woodworking trades	41,795
Pipe trades	17,227
Trowel trades	15,756.
Painting trades	9,105
Sheet-metal trades	8,254
Other building trades	4,858

♦ Sixty-three evaluations of films and film strips that may be used by teachers of business subjects have been prepared as a group project by members of Kappa Chapter of Delta Pi Epsilon. Each evaluation summarizes the film, enumerates its educational purposes, and suggests ways of using the visual aid effectively in the classroom. These evaluations have been prepared to guide the business teacher in the effective selection and utilization of films in business courses. Copies may be secured for one dollar by writing to the Vocational Instructional Materials Laboratory, School of Education, University of Michigan, Ann Arbor, Mich.

♦ The committee on engineering education of Compressed Air and Gas Institute, Cleveland, Ohio, announces a 30-minute illustrated lecture on compressed air power and its modern industrial applications.

Produced primarily as a teaching aid requested by engineering schools and colleges, and reviewed by a group of engineering professors, "Compressed Air in Action" contains 61 illustrations in either 35mm. continuous strip film or 2-in. by 2-in. film slides. The lecture is available at cost to industrial organizations, technical societies, high schools, vocational schools, foremen's clubs, service clubs, and any other interested groups. Its up-to-date information will be found valuable by anyone concerned with the application of compressed air.

All inquiries regarding "Compressed Air in Action" should be addressed to: Committee on Engineering Education, Compressed Air and Gas Institute, Room 1404, Terminal Tower Bldg., Cleveland 13, Ohio. The descriptive brochure will be sent on request.

♦ A comprehensive booklet, outlining basic standards of apprentice training for terrazzo workers, has been made available for the guidance of contractors and labor representatives in all parts of the United States in the development of skilled workers.

Copies of this booklet may be obtained free of charge by writing to the Bureau of Apprenticeship, U. S. Department of Labor, Washington 25, D. C. When requesting copies, please mention the publication in which this announcement appeared.

♦ A recent conference of representatives of the National Education Association and the American Library Association pointed out the increasing importance of the school library in elementary education and recommended that all teachers should be given courses of instruction in library materials and their use.

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NO. 2208
HEAVY DUTY 24" x 5"
JIG SAW

For fast, clean, accurate, vibrationless contour and straight cutting, inserted blade work, heavy jig sawing, die filing, saber sawing, and sanding of metals, woods and plastics. Only 24" jig saw that cuts materials up to 5" thick.

Instant control—from high tension for heavy sawing to a sensitive tension for delicate work such as inlaying. Guarantees longest possible blade life. Tension instantly released to make blade changing really fast and easy.

Oversize 20" x 20" highly polished, cast iron work table. Two-way tilt to 45°.

Finely balanced drive mechanism consists of a bronze cross-head, hardened steel cross slide, and a steel crank shaft—mounted upon highest quality ball bearings, giving a lifetime of trouble-free service. The reciprocating action is so smooth, the finest fret blades have long life. The drive mechanism is absolutely the strongest used on any 24" jig saw. Moving parts are fully splash lubricated.

50% longer blade-stroke cuts thicker stock faster.

The heavy one-piece, iron cast base with a broad flanged foot for mounting, prevents misalignment of moving parts.

Only 24" Jig Saw capable of using any blades 5" to 9" long. Many times the capacity and versatility of others. Blades may be turned 90° for ripping long stock.

SPECIFICATIONS:

Capacities: Under holddown—5".
Blade to frame—24".
Stroke: 1½".

Blade guides above and below table.

Overall: 39" high; 20" wide; 38" deep.

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for efficient sharpening of hand tools without danger of damage to tools or personal injury. Simplified self-adjusting friction roll drive. No countershaft or extra belt. Peripheral speed remains constant as wheel wears. No water thrown on operator. Permits proper pressure control. Operator works on top of the wheel. Large tool rest, the first with adequate adjustment.

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A book expresaly written for such courses has just been published by The H. W. Wilson Company. It is *Teaching Through the Elementary School Library*, by Margaret K. Walraven and Alfred L. Hall-Quest (183 pp., 13 photographs, $3. H. W. Wilson Co., New York 52). Librarians, as well as teachers and administrators, can gain much from reading this book.

Some of the subjects of separate chapters are: Comprehensive Reading Guidance, Selecting Books for Children to Grow On, Stimulating Reading, Library Information Tests, Short Cuts for Finding and Keeping Teaching Materials, Audio-Visual Aids to Teaching.

♦ A "building operation and janitorial service institute" was held recently at the Milwaukee Vocational School in co-operation with the Building Service Employees International Union. For three days eighty janitors took a refresher course in the special cleaning and maintenance problems of large public buildings.

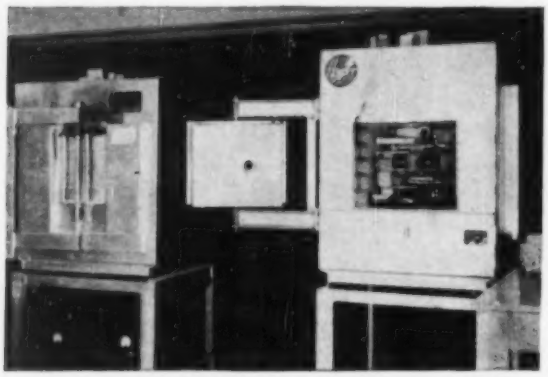
Building custodians attending were from Milwaukee and other Wisconsin cities. The union encouraged attendance by paying the fees of its members, but the course was open to all janitors.

Class sessions were held June 23–25 and certificates awarded janitors attending 10 of the 12 regular classes. Subjects covered included economics and their value; fuels, smoke and water; cleaning tools and equipment; illumination, fixtures, windows; furniture, metal, shades, and acoustical material; boilers; care of floors; cleaning materials and supplies, and safety.

Similar classes have been held in the past for school custodians. This was the first institute for janitors in office buildings, apartment houses, theaters, and schools.

♦ A new camera with accessories that make it a complete photomicrographic laboratory in a single unit, has been developed by Bausch &

(Continued on next page)



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for the

Advancement of Ceramic Art

IN SCHOOLS • UNIVERSITIES • ADULT EDUCATION PROGRAMS

The above photograph pictures two Harper High Temperature Studio Kilns installed at the Whitney Avenue Adult Arts and Craft's Center, Niagara Falls, New York. On the left is a side-fired model SK-101215-SF; on the right is an over-under-fired model SK-151416. The kilns are fired alternately with the same transformer control which can be seen under the lefthand kiln. This kiln installation provides maximum firing space at minimum equipment cost.

Mr. Waldon R. Oliver, Director of Adult Education, in Niagara Falls says: "The experience of our adult education instructors and students in Ceramics in working with our Harper kilns has been highly satisfactory and pleasant. The use of such excellent equipment has contributed much to the interest shown toward our 5 large pottery classes." *Write for Bulletin 1246.*

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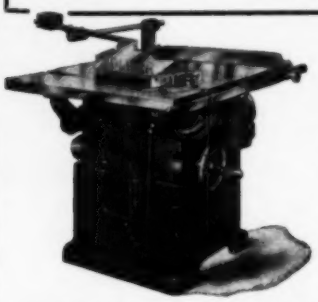

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Stands Hard Service

This Saw Bench, giving outstanding service in industry, has proved practical for school shops. The saw tilts to any angle up to 45° while table remains horizontal. It rips to 27" wide, cross cuts to 13" wide. Cuts perfect miters. New automatic saw guard with anti-kick back catch and adjustment for tilting saw assure greater safety.

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Band Saws
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Sanders
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Wood Trimmers
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Write for Bulletins

OLIVER MACHINERY COMPANY

GRAND RAPIDS 2, MICHIGAN

(Continued from previous page)

Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y.

Suitable for photographing a full range of microscopic and macroscopic studies, including phase contrast, the camera has a reflex back that permits the photomicrographer to compose conveniently pictures up to five by seven inches in size.

For copying work, the camera may be quickly removed from its vertical position and placed horizontally on the sliding baseboard. Lenses for copy work are provided for both black and white, and full color work.

Motorists can't see pedestrians at night as easily as pedestrians can see autos. The National Safety Council says that fundamental fact should make walkers extra careful. Don't spend a lifetime in crossing streets!

Ease up in a freeze-up! The National Safety Council says when the mercury goes down, traffic accidents go up. The reasons: slippery pavement, poor visibility. Keep your mind and your windshield clear — and slow down!

Traffic laws are here to stay — are you? Safety means observing laws, and watching for those who don't. Traffic laws are not annoyances to be ignored. The National Safety Council says they are for your protection. Don't learn about them by accident!

New Publications

Ornamental Designs and Illustrations

By J. M. Bergling. Cloth, 84 pp., 8⅛ by 11 in., $5.

Art Alphabets and Lettering

By J. M. Bergling. Cloth, 73 pp., 8⅛ by 11 in., $4.

Art Monograms and Lettering

By J. M. Bergling. Cloth, 102 pp., 8⅛ by 11 in., $5. Published by V. C. Bergling, P. O. Box 523, Coral Gables, Fla.

These three books contain illustrative material that may be of great use to commercial artists and letterers.

The one on ornamental designs and illustrations is in its third edition. It contains a large collection of medallion designs, nature studies, ornamental and patriotic designs, reptile studies, and period designs.

The book on art alphabets and lettering is in its eighth edition. It contains about 70 different alphabets, examples of engrossed lettering, monographs, borders, etc.

The book on art monograms and lettering is in its seventeenth edition. It presents hundreds of monograms and engravers and designers will find much help and enjoyment in its pages.

Small House Carpentry

By Lee Frankl. Paper cover, spiral building, 100 pp., 8¾ by 10⅞ in., illus., $2.95. Prentice-Hall, Inc., New York, N. Y.

The author of this book is the director of Training-Thru-Sight Associates, a New York City visual aids education firm. The text matter, written and illustrated in simplified form, is based on the method used in preparing the basic visual training manuals for the army and navy.

The book follows but one house plan in order that the explanation of the relationships between the various parts may be more easily understood. It also shows how to use stock sizes so that cost of material and labor may be reduced.

Each operation is presented in two parts. The first informs the reader of the names and uses of the parts, while the second shows how the operation is to be performed.

Installation and Servicing of Low Power Public Address Systems

By John F. Rider. Cloth, 204 pp., 5⅝ by 7¾ in., illus., $1.89. John F. Rider Publisher, Inc., 480 Canal St., New York 13, N. Y.

This book contains a discussion of the fundamentals of sound and the general problems encountered in the public-address field.

Microphones and phonograph pickups are then discussed, after which impedance matching, amplifiers, and loud-speakers are explained.

Installation and servicing are the subjects treated in the last two chapters.

Working With Plastics

By Arthur Dunham. Cloth, 225 pp., 7⅛ by 10⅛ in., illus., $3.50. McGraw-Hill Book Co., Inc., New York City.

A book combining related material and directions on how to perform the fundamental operations in doing craftwork with phenolic and acrylic plastics.

The book is well illustrated with line drawings and half tones, and the methods of handling the materials, safety suggestions, tools and equipment, are all clearly explained.

A glossary, a fine bibliography, and a list of manufacturers of plastics also are included.

Practical Shop Mathematics — Volume One

By John H. Wolfe and Everett R. Phelps. Cloth, 371 pp., 5 by 7⅞ in., illus., $2.40. McGraw-Hill Book Co., New York, N. Y.

(Continued on page 32A)

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On everything in latest metal and woodworking machine tools and accessories. We sell nationally known products only. Most of the following items are carried in stock.

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- BENCH & FLOOR TILT ARBOR SAWS, all sizes
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- SANDERS, all types
- PLANERS, SHAPERS, VISES, woodworking
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- AIR COMPRESSORS, PAINT SPRAYS
- A.C. WELDING UNITS, ELECTRIC & CHAIN HOISTS
- SHEET METAL CRAFT EQUIPMENT
- PRESSES, arbor, Hydraulic, etc.
- DIESEL POWER GENERATING UNITS 3½ H.P. and up
- FURNACES, gas & electric, FORGES gas & electric
- BEAVER Portable Pipe and Bolt Threading Machines
- HAND TOOLS AND CHESTS
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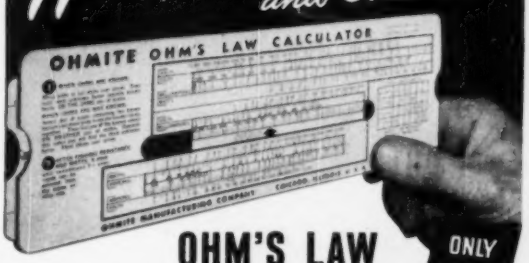

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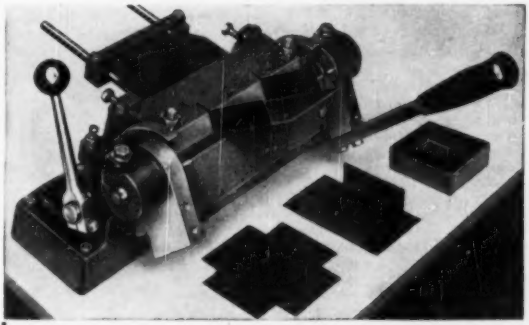

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Here is an interesting and practical student training project which teaches ingenuity in forming methods with modern equipment. Step I. The four corners of the flat material are notched with the DI-ACRO Notcher (not illustrated). Step II. Two sides of the box are formed with the DI-ACRO Brake as shown. Step III. The top forming bar on the brake is slotted to allow the previously formed sides to enter, while last two sides are formed.

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describing "Die-Less Duplicating" with all six DI-ACRO Precision machines — Benders, Brakes, Shears, Rod Forters, Notchers, Punches — and showing many examples of duplicated parts.

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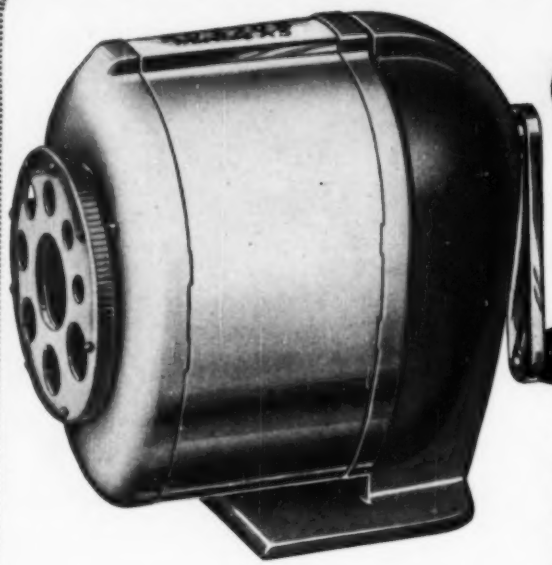

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Also Manufacturers of Speedball Pens and Products—Hunt Pens

(Continued from page 30A)

This is the third edition of this book and it is a complete revision.

It contains a thorough review of arithmetic, and then presents introductory courses on algebra, geometry, and trigonometry.

The use of the slide rule also is explained.

There are a great many shop problems provided for the beginner to try out the knowledge he has gained.

The selection of the shop problem is particularly good.

Machine Design Drawing Room Problems

By C. D. Albert. Cloth, 519 pp., 6 by 9¼ in., illus., $5. John Wiley & Sons, Inc., New York City.

This is the fourth edition of this valuable and helpful book. The material contained in it was revised and enlarged for this printing.

In its 26 chapters it covers strength of materials, allowable stresses, combination stresses, balancing problems, and tolerances and allowances for metal fits.

Besides this informational engineering material, there are 16 engineering problems for the reader to solve. The book also contains many tables of a mathematical and engineering nature.

Practical Color Simplified

By William J. Miskella. Cloth, 128 pp., $5. Miskella Infra-Red Co., Cleveland, Ohio.

A practical color expert has prepared this book to familiarize interior decorators and other color users with the commonly needed theory on color, the widely used facts of color harmony and matching, basic color designation and pigments, and color testing. Some of the recent developments of color use in connection with fluorescent lighting and color reflectance are included.

The book includes a number of significant color plates but provides the chromatic circle in diagrammatic form only, thus omitting the most frequently needed color aid.

Aluminum Sheet and Plate

Paper, 48 pp., 5¾ by 8¾ in. Produced by Reynolds Metals Co., Louisville 1, Ky.

This 48-page booklet contains much technical information relative to various sheet and plate alloys, gauges, sizes, and data as to formability, weldability, riveting, brazing, soldering, machinability and resistance to chemical attack.

A copy may be had on request.

The Training of Employees and Managers

By Earl G. Planty, William S. McCord, and Carlos A. Efferson. Cloth, 278 pp., 6¼ by 9¼ in., illus., $5. The Ronald Press, New York City.

A textbook on the comparatively new science of personnel training. The book is divided into three parts, the first of which describes what this training can do for the worker as well as for the firm for which he works. Part two discusses the qualifications of the training director, and the organization and administration of the training program.

Part three describes the training program, its scope, and how it is to be carried out with the new employe, the supervisor, and even top management.

Mechanical Drawing at Work

By William W. Rogers and Robert H. Barnes. Cloth, 186 pp., 7¾ by 10¼ in., illus., $2.48. Silver Burdett Co., 45 East 17th St., New York City.

This is one of the "At Work" series of textbooks. It contains 40 jobs which are divided into 11 units: Unit 1 teaches the student how to make three-view drawings. Unit 2 contains jobs requiring two- and one-view drawings. Unit 3 gives directions for making sectional views; 4 covers screw threads; 5, gears, cams, and assemblies; 6, woodworking; 7, welding; 8, sheet-metal work; 9, piping, plumbing, and air conditioning; 10, electrical wiring; and 11, the making of pictorial drawings.

Introduction to Tool Engineering

By Halsey F. Owen. Cloth, 149 pp., 6¼ by 9¼ in., illus., $3.60. Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N. Y.

A brief, yet thorough, exposition of what is understood under the title of this book. Tool engineering is not a new thing to be introduced, but with the complexity of modern industrial progress, it is a subject that must be increasingly better understood and more closely studied.

A brief glance at the table of contents makes clear how well the author has covered the subject. There are 10 chapters under the following headings: (1) Introduction to Tool Engineering; (2) Manufacturing Methods and Equipment; (3) Methods and Parts Analysis; (4) Operation Sheets and Bills of Material; (5) Designing for Production; (6) Manufacturing Costs; (7) Tooling Programs and the Economics of Tooling; (8) Tool Design; (9) Interchangeable Manufacture; (10) Estimating Tool Costs.

Popular Mechanics Motorists Handbook

Compiled by the Editors of Popular Mechanics Magazine. Cloth, 156 pp., 6⅝ by 9½ in., illus., $2. Popular Mechanics Press, 200 East Ontario St., Chicago 11, Ill.

This helpful book containing 535 hints on how to keep motorcars in a more serviceable shape. It has been published specially for the average driver who needs to know how to care for his clutch; judge when car parts are to be replaced; service the battery, starting motor, and generator; install new springs; locate troubles when the electrical system is not working properly; and retouch or renew the paint job on his car.

It takes less time to do a thing right than it does to explain why you did it wrong. — *Henry W. Longfellow.*

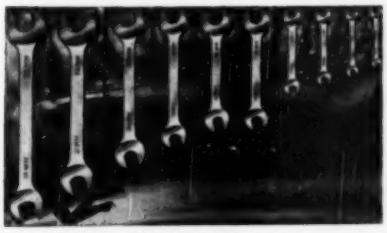
Shop Equipment News

NEW PRODUCTS — PUBLICATIONS

PROTO METRIC-SIZE OPEN END WRENCHES ADDED

Ten new Proto open end wrenches with metric-size openings have been announced by the Plomb Tool Company, Los Angeles 54, Calif. They are intended for mechanics who maintain foreign-made equipment. Opening size combinations, in millimeters, are 6 x 7, 8 x 9, 10 x 11, 12 x 13, 14 x 15, 16 x 17, 18 x 19, 20 x 22, 21 x 23, and 24 x 26. This wide range of sizes makes the wrenches suitable for Italian and French automobiles, as well as gear cutters and other types of industrial equipment made in Europe. The wrenches are forged, and they have smooth shanks and polished heads. Two sets of these new Proto wrenches also have been announced. No. 30000A contains all ten metric wrenches in a Velon kit. No. 30000R contains six wrenches — with opening sizes from 8 to 19 millimeters.

For brief reference use IAVE—0201.



Proto metric-size open end wrench set No. 30000A

NO. 65 MARKING GAUGE

Stanley Tools, New Britain, Conn., announces its new No. 65 Marking Gauge. A distinctive change from the conventional type of gauge; this new design, coupled with a specially sharpened marking pin which scores a knife type line, practically eliminates the tendency to follow the grain of the wood.

Stanley No. 65 marking gauge

The design of the gauge permits free movements of the beam and still insures absolute locking when the beam is wedged into the V-shaped opening in the head by the thumb screw and shoe.

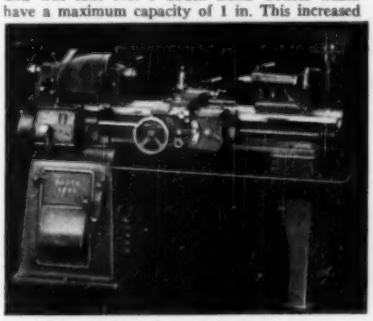
The gauge is made of boxwood, lacquered finish, and graduated in 16th of inches for 6 in.

For brief reference use IAVE—0202.

NEW 13-IN. SWING LATHE WITH 1-IN. COLLET CAPACITY

A new series of 13-in. swing toolroom and quick change gear lathes is now being manufactured by the South Bend Lathe Works. New features include an improved headstock spindle with increased bore and collet capacity, new tailstock base with improved bed way wiper system, and new one-point oiling system for reverse lever bracket and twin gear bearings.

The new headstock spindle has a 1 ⅜-in. bore and will take No. 5 South Bend Collets which have a maximum capacity of 1 in. This increased

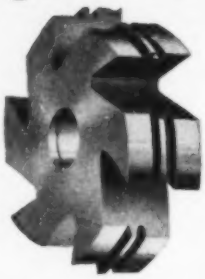


13-in. swing, 1-in. collet capacity, toolroom lathe

(Continued on page 35A)

You Can Depend On

Champion Two-In-One Glue Joint Cutter



This cutter makes a perfect glue joint with a single cutting tool, it being so formed that a tongue and groove fit perfectly by merely reversing the stock. It is a positive time saver in changing cutters and handling stock. Extra holding surface for the glue and large matched sections make a solid joint.

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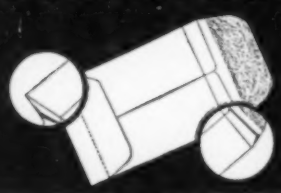

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A special "safety-fold" treatment makes an ordinary coin envelope into a sift-proof, solid package body at a nominal expense. This type of container enjoys great popularity with seed or powder men that have free flowing materials to package.

The coin envelope has also found itself in many plants that pay by cash. The sizes can accommodate printed forms for deductions, etc., and provide ample security and protection to the contents.

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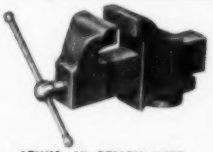
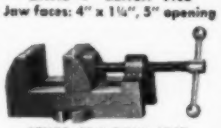


LEWIS 4" BENCH VISE
Jaw faces: 4" x 1¼", 5" opening



LEWIS 2¾" DRILL VISE
Jaw faces: 2¾" x 1¼", 3⅛" opening

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(Continued from page 33A)

spindle capacity permits machining 1 3/8-in. bar stock fed through the spindle and a suitable chuck. Bar stock up to 1 in. may be fed through the spindle and No. 5 South Bend Draw-in Collet Assembly. The bearing surfaces on the spindle are finished to a smoothness of 5 microinches (profilometer reading .000005 in. r.m.s.) and have a hardness of 56 to 61 Rockwell C.

The spindle turns in split sleeve bronze alloy bearings. Large individual oil reservoirs and an improved capillary oiling system provide them with a complete film of clean filtered oil. These reservoir drains are provided so that they may be periodically flushed clean.

The new tailstock base wiper system is designed to keep the bed ways for the tailstock base free of chips, grit, and dirt.

The new lathe provides an unusually wide range of spindle speeds. The belt drive to the spindle is silent in operation and develops smooth, steady power, entirely free from gear vibrations. It is provided with a precision belt tension adjustment.

General specifications of the new 13-in. lathes are: 13 1/8-in. swing over bed; 7 3/4-in. swing over saddle cross slide; 48 pitches of screw threads — 4 to 224 per inch r.h. or l.h.; 48 longitudinal power feeds — .0015 to .0841 in. r.h. or l.h.; 48 power crossfeeds — .0006 to .0312 in.; 8 spindle speeds — 34 to 875 r.p.m.; 4-, 5-, 6-, or 7-ft. bed lengths.

The No. 5 South Bend Collets used are available in 61 fractional capacities down to 1/16 in. for round stock. Decimal sizes, metric sizes, and square or hexagon No. 5 collets can be supplied on special order. These collets are interchangeable with those used on 10-, 14 1/2-, 16-, and 16/24-in. South Bend Precision Lathes.

Catalog No. 73 describing these new 13-in. swing South Bend Lathes may be secured by writing to the South Bend Lathe Works, 178 East Madison St., South Bend 22, Ind.

For brief reference use IAVE—0203.

THE NEW DI-ACRO RADIUS BRAKE NO. 4

The Di-Acro Radius Brake No. 4 has now been put on the market. It is a precision machine capable of properly forming duraluminum, chrome molybdenum, rust resistant and spring tempered alloys, and various other low ductile materials.

This precision radius brake entirely eliminates the possibility of fracture or disintegration developing at the line of forming. This tendency is always inherent in alloys of low ductility when cold drawn forming is attempted without provision for the establishment of the exact radii necessary in accordance with the ductile limits of the material.

Case-hardened and spring-tempered materials that must be formed after heat-treating can also be safely and economically worked to accurate dimensions with the Di-Acro Radius Brake. The radius used in each case must be sufficient to provide uniform expansion of the material surface where the fold occurs. If the radius is correctly established, any possibility of fracture or break in the material will be prevented.

No. 4 Di-Acro radius brake

The Di-Acro radius brake will also form sharp "no radius" bends such as are usually obtained with a standard style brake.

Specifications: Material capacity, 16-gauge sheet steel (.062 in.). Forming width, 24 in. Degree of forming, 125 deg. Radii obtainable with standard forming bars, 0, 1/16, 3/32, 1/8, 5/32, 3/16, and 7/32 in.

For further information write to O'Neil-Irwin Manufacturing Co., Lake City, Minn.

For brief reference use IAVE—0204.

NEW DISSTON ONE-MAN CHAIN SAW

A powerful, lightweight one-man chain saw which operates with equal efficiency in any cutting position, has been announced by Henry Disston & Sons, Inc., Philadelphia manufacturers of saws, woodworking tools, and special alloy steels.

This new saw is especially useful for light felling and bucking, for limbing and construction timber cutting.

Special features of the saw, which has an 18-in. cutting capacity, include a 2-cycle, air-cooled Mercury gasoline engine delivering 3 1/2 h.p. at 4000 r.p.m. A specially designed fuel system permits operation at top efficiency even when the saw is used upside down for inverted bucking. A fuel meter assures positive flow of properly mixed fuel to the cylinder, at the same time functioning as a governor to control engine speed. The magneto, of the crankshaft type, is protected against moisture and dirt and assures positive ignition under all working conditions.

Starting is made easy by the self-rewinding Magnapull Starter, which is built into the engine,

(Continued on next page)

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(Continued from previous page)

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For brief reference use IAVE—0205.

HOME-UTILITY ELECTRIC DRILL KIT

A new ¼-in. electric drill kit is being made by The Black & Decker Mfg. Co. This kit contains everything necessary for drilling for cabinetwork, sharpening knives and tools, removing rust and old paint, polishing hardware, burnishing metal parts, drilling out broken rivets, grinding off burrs, cleaning with wire brush, and countless other "odd jobs."

Black & Decker kit

Especially useful in the home workshop or on the farm this handy steel kit box is compactly fitted and contains the popular ¼-in. home-utility drill; horizontal stand for mounting the drill on a workbench; 13 high-speed drill bits, 1/16 to ¼ in. inclusive; one 4-in. wire wheel brush; one 3-in. general purpose grinding wheel; one 3-in. cotton buffing wheel; one tube of polishing and buffing compound; and one wheel arbor.

The ¼-in. drill which operates on any standard 110-volt a.c., or d.c., is made of strong, light die-cast aluminum housings and weighs only 3¼ lb. It has an instant-release trigger switch, but may be locked in an "on" position which is particularly advantageous when used in the horizontal stand because both hands are freed for applying the work.

The drill kit also is provided with an abrasive kit, a buffing and polishing kit, and a bench stand for more specialized work in the hobby shop, home, farm, or repair kit.

For brief reference use IAVE—0206.

NEW CINCINNATI DIAL-TYPE MILLING MACHINES

A new dial-type milling machine, announced by The Cincinnati Milling Machine Co., is built in medium and high-speed ranges, plain, universal, and vertical styles, Nos. 2, 3, and 4 sizes for each (18 different machines).

Like earlier dial types, the new machines have power speed and feed change, operable with a single two position lever at the front control position or a similar lever at the left-hand side of the column.

Plastic speed and feed dials are centered with each other. A spindle speed calculator, also on the same center but fixed to the casting, eliminates guesswork in selecting the most suitable cutter speed.

High speed machines have 21 spindle speeds 20 to 1400 r.p.m. for the No. 2 size, and 18 to 1500 r.p.m. for the Nos. 3 and 4 sizes, in approximate geometrical progression. Twenty-four feeds, also in geometrical progression, cover a range of 5/16 to 60 in. per minute. Medium speed machines have a slightly smaller selection of

(Continued on next page)

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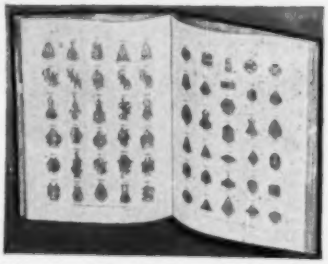

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(Continued from previous page)

speeds and feeds, and the upper limits are 1/3 those for high speed machines.

Vertical dial types have hydraulic counterbalance for the vertical head. All dial types are equipped with built-in vibration damping units.

Lubrication is principally automatic. All parts within the column are lubricated by a pump and splash system; parts within the knee are lubricated by a similar system; saddle, housing, and table parts are lubricated from a built-in manually operated plunger pump.

Cincinnati Milling and Grinding Machine Company plain high speed dial-type milling machine

A coolant arrangement returns the cutting fluid to the reservoir in the base. Through cored openings in the table, saddle, and knee, the coolant flows to the space between two sets of telescopic tubing, one within the other. The inner tubing, incidentally, protects the vertical screw.

Electrical controls are built into a compartment at the right-hand side of the column. Start-stop push buttons are also built in, at the operator's rear working position, left-hand side of the column. Opening the motor compartment cover, as required for V-belt or motor inspection, automatically breaks the electrical circuit and stops the motor.

The motor is mounted on adjustable rails in the column. Power is transmitted to the main drive pulley through V belts and then to the spindle and feed drive through a large multiple disk clutch. To reduce operator effort, the clutch is equipped with a hydraulic booster. Power is supplied by 7½ h.p., 10 h.p., and 15 h.p. motors for the Nos. 2, 3, and 4 dial types, respectively.

Complete specifications may be obtained by writing to The Cincinnati Milling Machine Co., Cincinnati 8, Ohio. Ask for their publication No. M-1623.

For brief reference use IAVE—0207.

1948–1949 ALCOA LIBRARY CATALOG

This catalog, published by the Aluminum Company of America, 801 Gulf Building, Pittsburgh 19, Pa., lists the sound motion pictures, visual aids, and booklets which this firm publishes as an aid to teachers of industrial education.

Among the sound motion pictures are: Unfinished Rainbows; Curiosity Shop; This is Aluminum; Aluminum Fabricating Processes; Dateline Tomorrow; General Sheet Metal Practice; Blanking and Piercing; Drawing, Stretching, and Stamping; Tube and Shape Binding; Spinning; Machining Aluminum; Riveting Aluminum; Brazing Aluminum; Torch Welding; Arc Welding; and Resistance Welding.

There are also approximately 20 booklets listed,

(Continued on next page)

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GRAPHIC ARTS PROCEDURES by R. Randolph Karch. Not just a "typesetting" book but a lucid textbook for schools that gives comprehensive coverage of all processes and procedures. A practical and logical approach that meets today's needs. Price, $3.75

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STRENGTH OF MATERIALS by Harris. There is a quantity of related information in this field that is important to every machine-trades trainee. This book supplies that information in a form that you can use even with beginning students.

VOCATIONAL EDUCATION IN A DEMOCRACY by Prosser-Quigley. For years the Prosser-Allen edition of this book has been a standard reference. Now Prosser-Quigley bring out what is really an "addition" instead of an "edition" of a book that was so fundamentally sound that it has guided the course of vocational education for many years.

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(Continued from previous page)

besides 8 art pictures, and a chart on the history and chemistry of aluminum.

There is no charge for the use of the motion pictures, but payment of transportation charges, both ways, is expected.

All of the correlated material on aluminum is gratis to teachers, supervisors, and directors of industrial arts and vocational education.

For brief reference use IAVE—0208.

TEACHING AIDS

The educational department of the Behr-Manning Corp., Troy, N. Y., is offering the following free teaching aids to shop teachers who apply for them: Lecture Course Supplement — "Coated Abrasives in the Plastics Industry." Lecture Course Supplement — "Coated Abrasives in the Metal Working Industry."

Wall charts are available in single copies, for industrial arts and vocational instructors: "Industry's Woodworking Abrasives." "Coated Abrasives for Finishing Metal," "Coated Abrasives Descriptions and Uses," and "Industry's Oilstones."

Booklets are available in units of 25 copies to instructors of industrial arts and vocational shops for the class library: 25 "Sandpaper — How and Why," and 25 "How to Sharpen."

Shop Projects available in reasonable quantities for individual student use in industrial arts and vocational classes: sets of eight shop projects on abrasives, covering coated abrasives, oilstones, manufacturing, selection, and application.

This offer good only in the U. S. A., and possessions.

For brief reference use IAVE—0209.

NEW MUMMERT-DIXON BULLETINS

A bulletin on facing heads and one on spot facing tools have just been issued by Mummert-Dixon Co., Hanover, Pa.

The bulletin on facing heads describes and illustrates one-way feed heads, two-way feed heads varying from 6 to 46 in. It also shows the application of these facing heads to horizontal boring mills, drill presses, and lathes.

The bulletin on spot facing tools describes the roughing and finishing cutters, varying from 2½ to 6-in. diameters, made by this firm.

For brief reference use IAVE—0210.

CASTOLITE INSTRUCTION MANUAL

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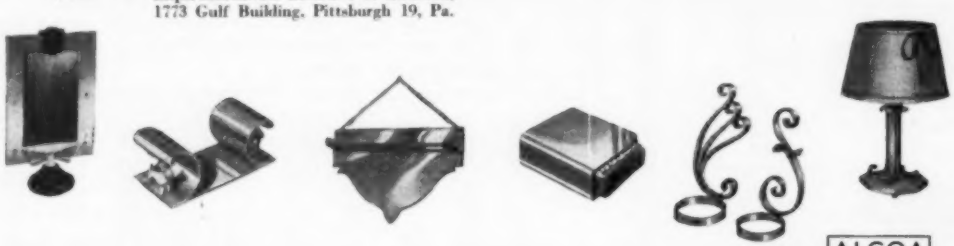

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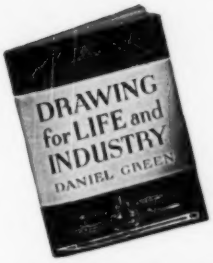

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